FLOWSERVE™

Flow Control Division

Logix 1400 Digital Positioner

Installation & Reference Guide

DEVICE_TYPE 0202

Introduction

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About This Publication

This manual is intended as a ‘how to’ reference for installing, wiring, configuring, starting up, and operating the Valtek Logix 1400 digital positioner with FOUNDATION fieldbus (FF).

This manual provides detailed information for installation and operation to assist first-time Logix 1400 digital positioner users.

This manual is written as the technical guide for the experienced fieldbus user. It does not contain information on fieldbus communications and usage. It is recommended that a user new to fieldbus attend the training courses that are taught by the Fieldbus Foundation to obtain the background knowledge that is needed to operate a fieldbus segment. Refer to *Contacting the Fieldbus Foundation* on page x.

About This Manual

This manual provides installation, operation, maintenance for the Logix 1400 digital positioner with FOUNDATION fieldbus communications. Reference information is also provided.

The sections of information contained in the manual follow this order:

- Background and pre-installation
- Logix 1400 digital positioner mechanical and electrical installation
- Logix 1400 digital positioner configuration
- Operation
- Reference information

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Symbol Definitions

This CAUTION symbol on the equipment refers the user to the installation manual for additional information. This symbol appears next to required information in the manual.

ATTENTION, Electro-Static Discharge (ESD) hazard. Observe precautions for handling electrostatic sensitive devices.

Earth Ground. Functional earth connection. **NOTE:** This connection shall be bonded to protective earth at the source of supply in accordance with national and local electrical code requirements.

Abbreviations

AO	Analog Output
AWG	American Wire Gauge
DB	Database
DD	Device Description
DDL	Device Description Language
EEPROM	Electrically Erasable Programmable Read Only Memory
EMI	Electromagnetic Interference
FB	Function Block
FBAP	Function Block Application Processor
FF	FOUNDATION fieldbus
mA	Milliamperes
mmHg	Millimeters of Mercury
LAS	Link Active Scheduler
MSP	Manufacturer's Signal Processing
NM	Network Management
NMA	Network Management Agent
NMIB	Network Management Information Base
NPT	National Pipe Taper (pipe threads)
NV	Non-volatile
OD	Object Dictionary
OOS	Out-of-service
PC	Personal Computer (workstation)
PID	Proportional Integral Derivative
PROM	Programmable Read Only Memory
PWA	Printed Wiring Assembly
RAM	Random Access Memory

RFI	Radio Frequency Interference
ROM	Read Only Memory
SM	System Management
SMA	System Management Agent
SMIB	System Management Information Base
VCR	Virtual Communication Reference
VDC	Volts Direct Current
VFD	Virtual Field Device
XMTR	Transmitter

Definitions

Term	Abbrev.	Definition
Alarm		The detection of a block leaving a particular state and when it returns back to that state.
Analog Output (function block)	AO	One of the standard function blocks defined by the Fieldbus Foundation.
Application		A software program that interacts with blocks, events and objects. One application may interface with other applications or contain more than one application.
Block		A logical software unit that makes up one named copy of a block and the associated parameters its block type specifies. It can be a resource block, transducer block or a function block.
Configuration (of a system or device)		A step-in system design: selecting functional units, assigning their locations and identifiers, and defining their interconnections.
Device		A physical entity capable of performing one or more specific functions. Examples include transmitters, actuators, controllers, operator interfaces.
Device Description	DD	Description of FBAPs within a device.
Device Description Language	DDL	A standardized programming language (similar to C) used to write device descriptions.
Device Tag		User-defined identifier for device.
Event		An instantaneous occurrence that is significant to scheduling block execution and to the operational (event) view of the application.
FOUNDATION fieldbus	FF	Communications protocol for a digital, serial, two-way system that interconnects industrial field equipment such as sensors, actuators and controllers.
Function Block	FB	An executable software object that performs a specific task, such as measurement or control, with inputs and outputs that connect to other entities in a standard way.
Function Block Application Process	FBAP	The part of the device software that executes the function blocks (PID, AO, transducer, or resource blocks).
Link Active Scheduler	LAS	A device which is responsible for keeping a link operational. The LAS executes the link schedule, circulates tokens, distributes time messages and probes for new devices.
Macrocycle		The least common multiple of all the loop times on a given link.
Manufacturer's Signal Processing	MSP	A term used to describe signal processing in a device that is not defined by FF specifications.

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Term	Abbrev.	Definition
Network Management	NM	A set of objects and services that provide management of a device's communication system.
Network Management Agent	NMA	Part of the device software that operates on network management objects.
Network Management Information Base	NMIB	A collection of objects and parameters comprising configuration, performance and fault-related information for the communication system of a device.
Objects		Entities, such as blocks, alert objects, trend objects, parameters, display lists, etc.
Object Dictionary	OD	Definitions and descriptions of network visible objects of a device. Various object dictionaries are contained within a device. The dictionaries contain objects and their associated parameters which support the application in which they are contained.
Parameters		A value or variable which resides in block objects.
Proportional Integral Derivative control	PID	A standard control algorithm. Also refers to a PID function block.
System Management	SM	Provides services that coordinate the operation of various devices in a distributed fieldbus system.
System Management Agent	SMA	Part of the device software that operates on system management objects.
System Management Information Base	SMIB	A collection of objects and parameters comprising configuration and operational information used for control of system management operations.
Status		A coded value that qualifies dynamic variables (parameters) in function blocks. This value is usually passed along with the value from block to block. Fully defined in the FF FBAP specifications.
Transducer Block	XD	Similar to a function block, but performs functions specific to the device transducer, including measurement and calibration.
Virtual Communication Reference	VCR	A defined communication end-point. Fieldbus communications can primarily only take place along a active communications 'path' that consists of two VCR end-points. For example, to establish communications between a transducer AO block and another function block, a VCR must be defined at the transducer block and a VCR must be defined at the function block between the two function blocks.
Virtual Field Device	VFD	A logical grouping of 'user layer' functions. Function blocks are grouped into a VFD, and system and network management are grouped into a VFD.

References

Publications from the Fieldbus Foundation

Flowserve recommends that the user obtain these publications, which provide additional information on Fieldbus technology:

Publication Title	Publication Number	Publisher
Technical Overview, FOUNDATION fieldbus	FD-043	Available from the Fieldbus Foundation
Wiring and Installation 31.25kbit/s, Voltage Mode, Wire Medium Application Guide	AG-140	
31.25 kbit/s Intrinsically Safe Systems Application Guide	AG-163	
Function Block Application Process parts 1 & 2	FF-890, FF-891	Contained in the User Layer Specification FF-002
Fieldbus Specifications	Various Documents	

Contacting the Fieldbus Foundation

To order these publications and other information products produced by the Fieldbus Foundation, contact them at:

Fieldbus Foundation
9390 Research Boulevard
Suite II-250
Austin, TX 78759
USA

www.fieldbus.org/information/

Technical Assistance

If the user encounters a problem with the Logix 1400 digital positioner, the configuration of the Logix 1400 digital positioner should be checked to verify that all selections are consistent with the application.

If the problem persists, call Flowserve's U. S. Technical Assistance between the hours of 8:00 am to 4:30 pm MST — Monday through Friday — for direct factory technical assistance.

Phone: 801 489 2409
Fax: 801 489 2599
Help Desk: 801 489 2678

E-mail: digitalproducts@flowserve.com

An engineer will discuss the problem with the user. Please have the complete model number, serial number, and software revision number on hand for reference. The model and serial numbers can be found on the Logix 1400 digital positioner nameplate. The firmware revision numbers of the electronics boards and boot code can be found by

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accessing and reading the REVISION_ARRAY parameter in the resource block of the device. (For further details, see *Simulation Jumper* on page 30.)

If the engineer determines a hardware problem exists, a replacement Logix 1400 digital positioner or part will be shipped with instructions for returning the defective unit. Do not return the Logix 1400 digital positioner without authorization from Valtek Product Technical Assistance, or until the replacement has been received and a RGA (Return Goods Authorization) has been issued by Flowserve.

Note: Flowserve does not offer technical support for National Instruments' NI-FBUS Configurator software. Contact National Instruments' technical support at (512) 795-8248, or their local office, for assistance.

Fieldbus Device Version Checking

To assure the proper operation of the fieldbus device, always make sure the DDs loaded in the host configurator's library are the correct ones for the hardware version. Several different hardware versions of your fieldbus devices can possibly reside on various segments at the same time. Fieldbus Foundation has provided a means to tell which version of DD is needed for a particular device in its resource block.

The resource block contains the following standard parameters:

- MANUFAC_ID-- This contains the manufacture's Fieldbus Foundation™ registration ID number. Make sure this number matches the device used.
- DEV_TYPE-- This is the Foundation registered device type to designate what kind of device it is. Make sure the device type is correct for the unit.
- DEV_REV-- This is the current revision of the device.
- DD_REV-- This is the required DD revision level for this device. **Make sure the DD supports this revision level. An improper DD may cause unexpected operation or inability to use certain features.**

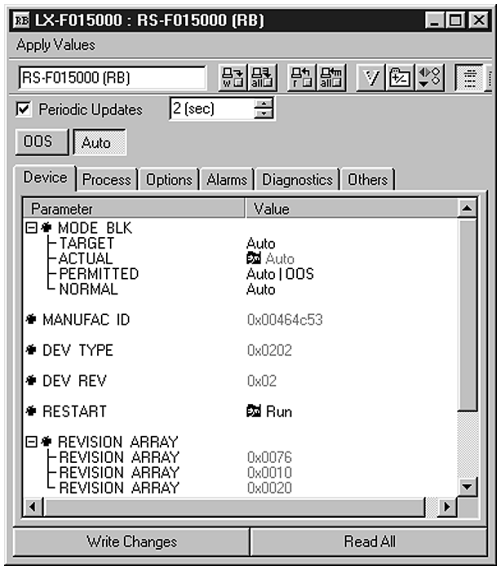
The DD files used with the host have names derived from DEV_REV and DD_REV as follows:

- <DEV_REV><DD_REV>.ffo
- <DEV_REV><DD_REV>.sym

Example: IF DEV_REV is 0x01 and DD_REV is 0x03, then the DD files would be 0103.ffo and 0103.sym.

In addition to these Fieldbus Foundation specified parameters, some manufactures may add additional device version information. The example below is of the resource block for a Flowserve Logix 1400 digital positioner. The revision array is an optional resource

parameter, but gives additional information about the internal firmware code versions. This array resides at the bottom of the parameter listing.



- **MANUFAC_ID:** This should always equal a 0x00464c53 (4607059), which is Flowserve's FF Manufacturer ID number. Converting this number to ASCII will produce FLS.
- **DEV_TYPE:** This will be 0x0202. This tells the configurator that the device is a Logix 1400 digital positioner.
- **DEV_REV:** This is the revision level of the device.
- **DD_REV:** This is the revision level of the DDs.
- **REVSION_ARRAY:** Three elements can be found in REVISION_ARRAY. Element number 1 (closest to the top) is the fieldbus (Honeywell) embedded software version. Element number 2 is the boot code revision level. The final element is the positioner embedded code revision.

Software Compatibility

This release of Fieldbus Software must be used with Positioner > Embedded codeEmE Embedded Code **versions 20 and later**. As a safety precaution, the Fieldbus > board checks the positioner embedded code revision. To determine the > actual software revision of the positioner board, check the Transducer > Block SOFTWARE_VER parameter or the Resource Block REVISION_ARRAY > element 3.

If the version number is less than 0x0020, the following actions are > taken:

1. The transducer block is placed permanently in OOS.
2. The transducer block BLOCK_ERR will display 'Other.'
3. The transducer block BLOCK_TEST parameter element 6 will be set equal to 12 (0x0c) and element 8 to 16 (0x10).
4. No further communication occurs with the control board.

NOTE: SOFTWARE_VER is displayed as a hexadecimal number.

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Section 1: Logix 1400 Digital Positioner Description

1.1 Introduction

About this Section

This section is intended for users who have never worked with the Logix 1400 digital positioner fieldbus positioner interface. It provides some general information to acquaint the user with the Logix 1400 digital positioner.

Flowserve recommends NI-FBUS Configurator software that runs on a variety of Personal Computer (PC) platforms using Windows® 95 or Windows NT™. It is a bundled Windows software and PC-interface hardware solution that allows quick, error-free configuration and diagnosis of Valtek control products with FOUNDATION fieldbus communications. The NI-FBUS Configurator allows users to communicate with the Logix 1400 digital positioner from a remote location to:

- Configure the Logix 1400 digital positioner by selecting and setting operating parameters.
- Access diagnostic information to identify configuration, communication, Logix 1400 digital positioner or process problems.
- Calibrate Logix 1400 digital positioner.
- Request and display Logix 1400 digital positioner data.
- Configure the Fieldbus network.

NI-FBUS Configurator (version 2.25 or higher) is compatible with the latest Logix 1400 digital positioner. Please contact a Flowserve representative for more information.

1.2 Fieldbus Logix 1400 Digital Positioner

About the Logix 1400 Digital Positioner

The Logix 1400 digital positioner is furnished with FOUNDATION fieldbus interface to operate in a compatible distributed fieldbus system. See Section 1.4 for an overview of fieldbus.

The Logix 1400 digital positioner includes FOUNDATION fieldbus electronics for operating in a 31.25 kbit/s fieldbus network. It features standard fieldbus function blocks with manufacturer-specific additions for enhanced operation. This Logix 1400 digital positioner is a Link Master device, which means it can function as the Link Active Scheduler in a fieldbus network.

In addition to providing the Fieldbus Interface the Logix 1400 digital positioner can also perform loop control functions. In conjunction with other FOUNDATION fieldbus compliant

devices, its function block set allows the formation of an extensive set of basic control applications.

Figure 1.1 Fieldbus Positioner (Logix 1400 Digital Positioner)

The Logix 1400 digital positioner in conjunction with any valve will, in essence, form a Fieldbus valve. When configured in conjunction with an Honeywell ST3000 fieldbus transmitter (for example) a complete control loop can be configured. Figure 1.2 shows a block diagram of the Logix 1400 digital positioner digital positioner operating with other instruments.

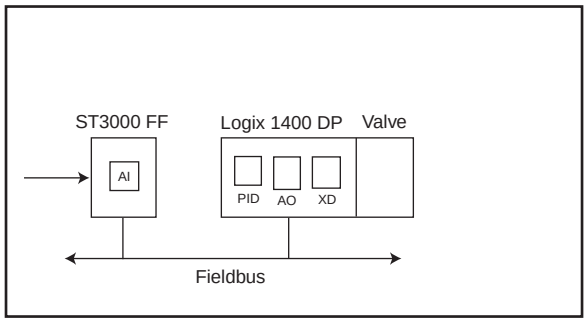

Figure 1.2 Functional Block Diagram of Logix 1400 digital positioner Operating with other instruments

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Theory of Operation

Figure 1.3 shows the basic positioning block diagram for the Logix 1400 digital positioner.

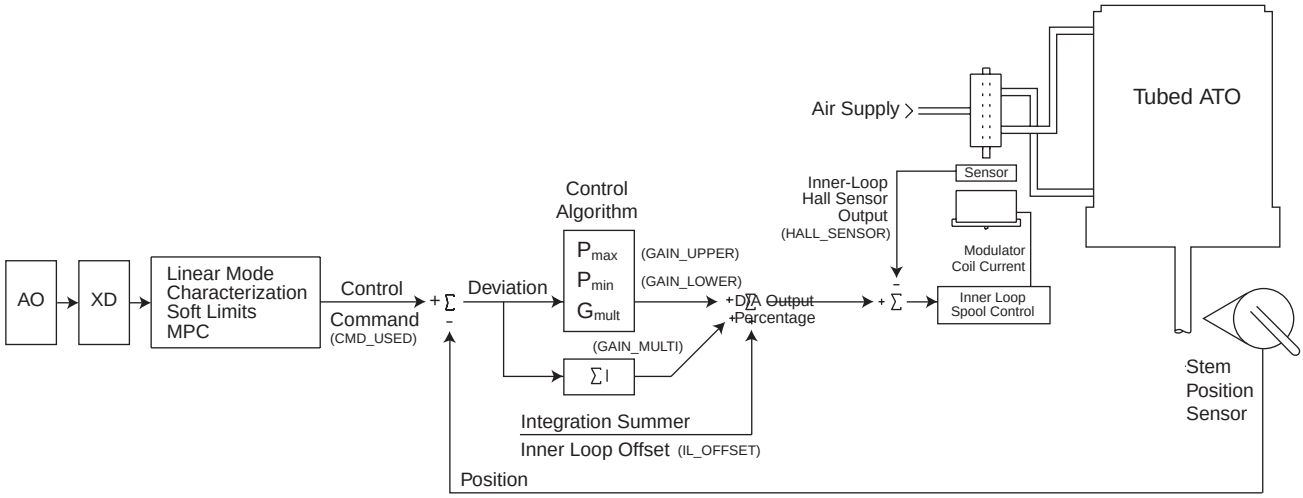

Figure 1.3 Logix 1400 Digital Positioner Block Diagram

NOTE: *Variable names in Figure 1.3 are internal names only and not accessible to the user. They are for reference use only.*

The Logix 1400 digital positioner receives power from the two-wire, fieldbus input signal. A digital signal, sent via fieldbus, is used as the command source. A value of 0 percent is **always** defined as the valve closed position and a value of 100 percent is **always** defined as the valve open position.

Next, the command value is passed through a characterization/limits algorithm block. The positioner no longer uses cams or other mechanical means to characterize the output of the positioner. This function is done in software, which allows for in-the-field customer adjustment. The positioner has two basic modes: *linear* and *custom* characterization. In linear mode, the command signal is passed straight through to the control algorithm in a 1:1 transfer. If custom characterization is enabled, the command source is mapped to a new output curve via a 21-point, user-defined curve. In addition, two-user defined features, **Soft Limits** and **MPC** (Minimum Position Cutoff; in fieldbus terminology these are called FINAL_VALUE_CUTOFF_HI and FINAL_VALUE_CUTOFF_LO), may affect the final command signal. The actual command being used to position the stem is called CMD_USED. The CMD_USED is the actual positioning command after any characterization or user limits have been evaluated.

The Logix 1400 digital positioner uses a two-stage, stem positioning algorithm. The two stages are comprised of an inner-loop, spool control and an outer-loop, stem position control. Referring again to Figure 1.1, a stem position sensor provides a measurement of the stem movement. The control command is compared against the stem position. If any deviation exists, the control algorithm sends a signal to the inner-loop control to move the spool, up or down, depending upon the deviation. The inner-loop then quickly adjusts the spool position. The actuator pressures change and the stem begins to move. The stem movement reduces the deviation between control command and stem position. This process continues until the deviation goes to zero. The control algorithm is both proportional and integral. This algorithm will be further explained later in the document.

A more detailed example to explain the control function follows. Assume the following configuration:

- Unit will receive its command from the FBAP
- Custom characterization is disabled (therefore characterization is linear)
- Soft limits or MPC functions are disabled
- Valve has zero deviation with a present input command of 50 percent
- Actuator is tubed air-to-open

Given these conditions, 50 percent represents a command of 50 percent. Custom characterization is disabled so the command is passed 1:1 to the CMD_USED. Since zero deviation exists, the stem position is also at 50 percent. With the stem at the desired position, the spool valve will be at a position in which no air flow is allowed to either side of the actuator. This is commonly called the null or balanced spool position. Upon a change in the command from 50 percent to 75 percent the positioner sees this as a command of 75 percent. With linear characterization, the CMD_USED becomes 75 percent. Deviation is the difference between control command and stem position: Deviation = 75 percent - 50 percent= +25 percent, where 50 percent is the present stem position. With positive deviation, the control algorithm sends a signal to move the spool **up** from its present position. As the spool moves **up**, the supply air is applied to the bottom of the actuator and air is exhausted from the top of the actuator. This new pressure differential causes the stem to start moving towards the desired position of 75 percent. As the stem moves, the deviation begins to decrease. The control algorithm begins to reduce the spool opening. This process continues until the deviation goes to zero. At this point, the spool will be back in its null or balanced position. Stem movement will stop. Desired stem position has now been achieved.

One important parameter should be discussed at this point: Inner loop offset. Referring to Figure 1.1, a number called inner loop offset (IL_OFFSET) is added to the output of the control algorithm. In order for the spool to remain in its *null* or *balanced* position, the control algorithm must output a non-zero spool command. This is the purpose of the inner loop offset. The value of this number is equivalent to the signal that must be sent to spool position control to bring it to a *null* position with zero stem deviation. This parameter is important for proper control and will be discussed further in the Control and Tuning section.

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1.3 Fieldbus Overview

Understanding Fieldbus

Fieldbus is an all-digital, serial, two-way communication system which interconnects industrial 'field' equipment such as sensors, actuators, and controllers. Fieldbus is a Local Area Network (LAN) for field instruments with built-in capability to distribute the control application across the network. See Figure 1.4.

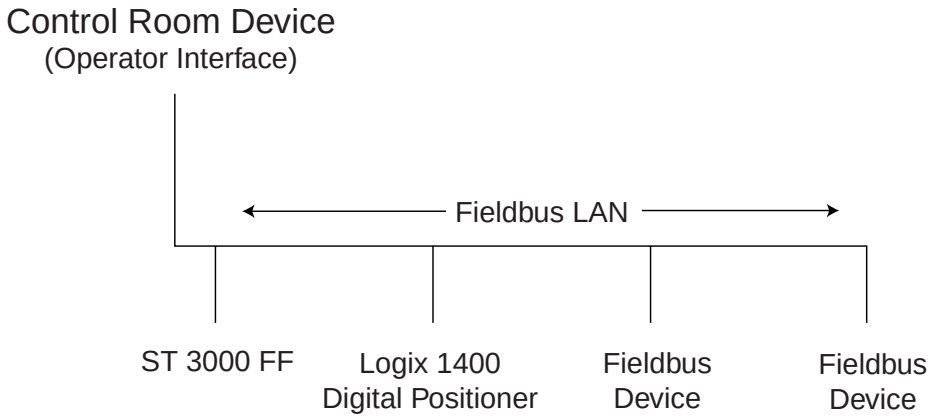

Figure 1.4 Fieldbus Connecting Control Room and Field Devices

Open System Design

The Fieldbus Foundation has defined standards to which field devices and operator/control stations communicate with one another. The communications protocol is an open system to allow all field devices and control equipment which are built to the FOUNDATION fieldbus standard to be integrated into a control system, regardless of the device manufacturer. This inter operability of devices using fieldbus technology is becoming the industry standard for automation and distributed control systems.

Hardware Architecture

The physical architecture of fieldbus allows installation of fieldbus devices using a twisted-pair cable. Often, existing wiring from analog devices can be used to wire up digital fieldbus devices. Multiple field devices can be connected on one cable (a multi-drop link), rather than conventional point-to-point wiring used for analog devices. See *Wiring the Logix 1400 Digital Positioner to a Fieldbus Network* on page 19.

Software Architecture

Fieldbus software architecture provides for more control functions to be available in the microprocessor-based field device. Since fieldbus is a digital communication system, more data is available to operators for process monitoring, trend analysis, report generation, and trouble analysis. Device software changes can be downloaded to field devices remotely from the operator station (or PC) in the control room.

Application

An application is software that contains function block data and operating parameters (objects) which help define the operation of a device such as, sensor data acquisition or control algorithm processing. Some devices may contain more than one application.

Function Blocks

Usually, a device has a set of functions it can perform. These functions are represented as function blocks within the device. See Figure 1.5. Function blocks are software that provide a general structure for specifying different device functions. Each function block is capable of performing a control function or algorithm. Device functions may include analog input, analog output, and Proportional Integral Derivative (PID) control. These

blocks can be connected together to build a process loop. The action of these blocks can be changed by adjusting the block's configuration and operating parameters.

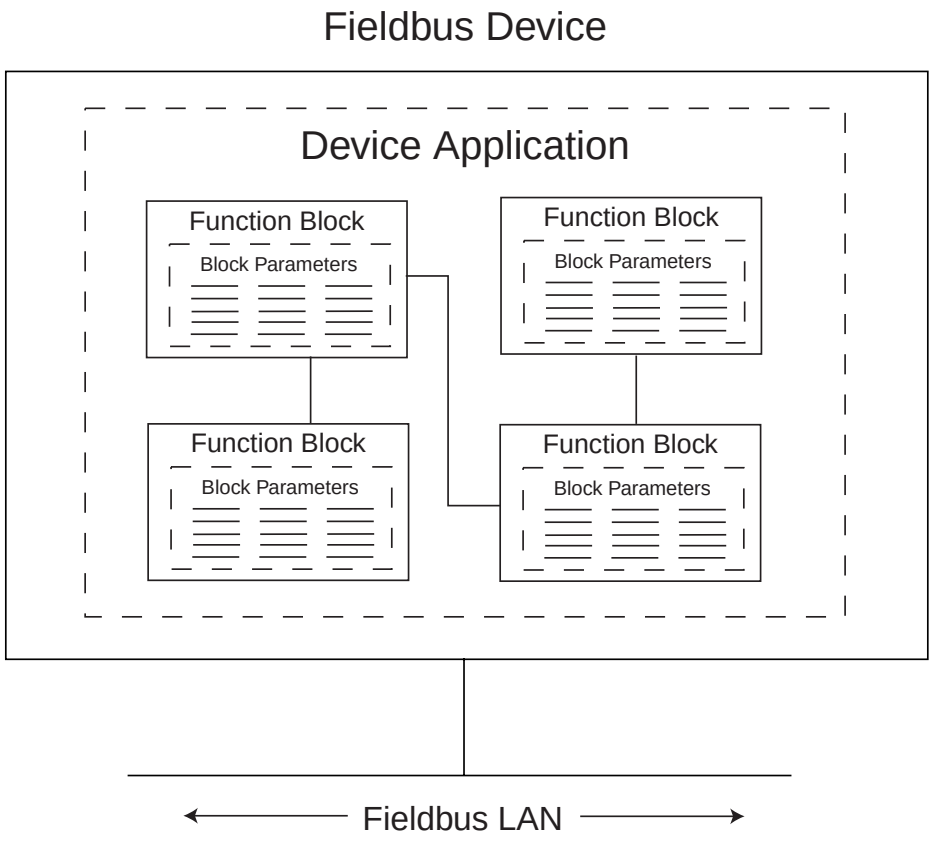

Figure 1.5 Fieldbus Devices Contain Device Applications and Function Blocks

Logix 1400 Digital Positioner Interface Application

The Logix 1400 digital positioner contains the electronics interface compatible for connecting to a fieldbus network. Logix 1400 digital positioner application is configured using a fieldbus configuration software program. The NI-FBUS Configurator software allows the user to configure blocks, change operating parameters and create linkages between blocks that make up the Logix 1400 digital positioner application. The changes to the Logix 1400 digital positioner application are then written to the device and initialized.

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Section 2: Installation Overview

2.1 Introduction

About This Section

This section provides a list of components needed to install and operate the Logix 1400 digital positioner. Also provided is a list of typical start-up tasks and places where the user can find detailed information about performing the tasks.

2.2 Installation Components

Components Needed for Installation

The Logix 1400 digital positioner contains electronics that enable it to operate using the FOUNDATION fieldbus protocol. This digital interface requires a number of components to provide control and data communications between field devices and the control room environment. Table 2.1 outlines the basic component parts needed to install and operate the Logix 1400 digital positioner on a fieldbus network.

Table 2.1 Components Required for Logix 1400 Digital Positioner Installation

Components	Description
Logix 1400 Digital Positioner	Fieldbus positioner.
Power supply	Furnishes DC power to fieldbus devices.
Power conditioner	Acts as a filter to prevent the power supply from interfering with the fieldbus signaling. (May be part of a fieldbus power supply.)
Fieldbus cable	Twisted pair shielded wire used to interconnect fieldbus devices.
Fieldbus terminators	A signal termination device used to prevent reflected signals (noise) from distorting field-bus communications.
Fieldbus IS Barriers (For hazardous area installations)	Intrinsic safety wire barriers are required for hazardous location installations.
Fieldbus wiring blocks	Wiring blocks allowing easy connection of devices, cable, terminators, surge suppressors and other fieldbus network components.

Operator Interface

In the control room an operator station, a personal computer or host computer acts as the operator interface to the fieldbus network. Using supervisory control software applications, the field devices on a fieldbus network can be monitored and controlled at the

operator interface. Figure 2.1 shows how these components go together to operate on a fieldbus network.

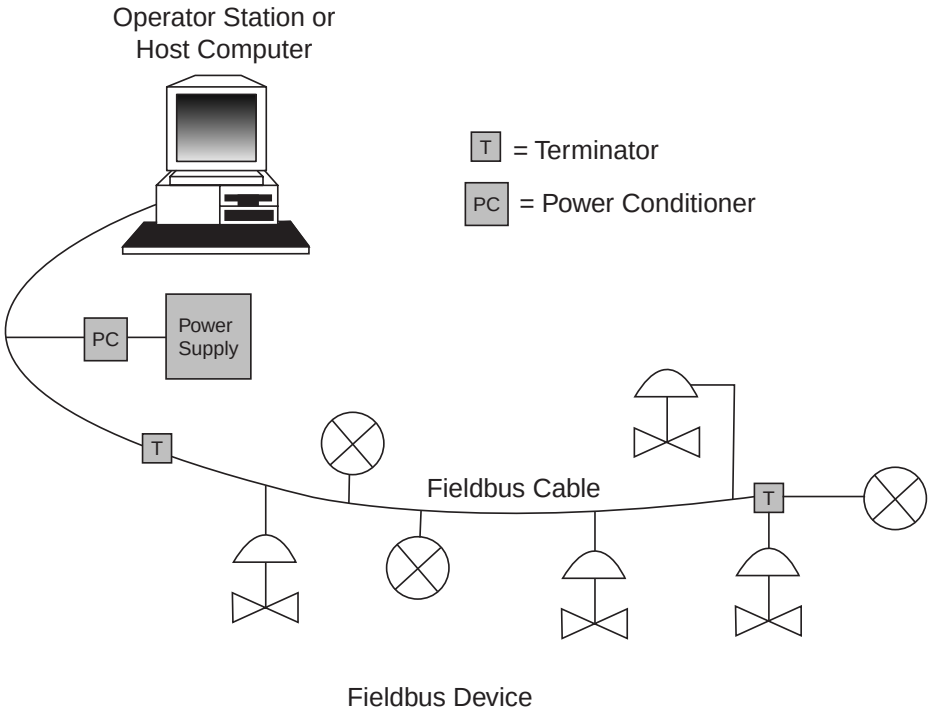

Figure 2.1 Fieldbus Network Components

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2.3 Installation / Operation Tasks

Installation Tasks

Installation of the Logix 1400 digital positioner is not difficult. The tasks for installing and operating the Logix 1400 digital positioner are outlined in Table 2.2.

Table 2.2 Installation / Operation Task Summary

Task	Procedure	Refer to . . .
-	Bench Check (optional) (Bench configuration)	Section 3, *Bench Configuration (Optional),* on page 11.
1	Pre-installation Considerations	Section 4, *Pre-installation Considerations,* on page 13.
2	Install Logix 1400 digital positioner Mounting • Wiring	Section 5, *Logix 1400 Digital Positioner Installation,* on page 17. Refer to *Logix 1400 Digital Positioner* IOM
3	Power Up Logix 1400 digital positioner	Section 5.4, *Powering Up the Logix 1400 Digital Positioner,* on page 23.
4	Establish Communications • Initial checks	Section 6.7, *Establishing Communications,* on page 30. Section 6.8, *Making Initial Checks,* on page 31.
5	Configure Logix 1400 digital positioner	Section 6.9, *Configuration Tasks,* on page 32. The user manual supplied with the fieldbus configuration application.
6	Operation	Section 7, *Operation,* on page 33. Also see supervisory control application documentation.
-	Periodic Maintenance • Calibration	Section 9, *Calibration,* on page 99. Section 10, *Troubleshooting,* on page 103.
-	Troubleshooting (if problems arise)	Section 11, *Software Maintenance,* on page 133.
-	Replacement (if needed)	Section 9, *Calibration,* on page 99.

Section 3: Bench Configuration (Optional)

3.1 Introduction

About This Section

The bench configuration is an optional procedure for checking your device. This section provides a procedure for configuring the Logix 1400 digital positioner. This allows the user to load configuration information into the device before it is connected in a fieldbus network. This enables the user to perform a bench check and configuration of the device before installation. Calibration is also possible before the device is installed in the field.

Device Calibration

A stroke calibration should be performed upon installation of the valve. The actuator pressure calibration should be verified on advanced models (Logix 1410 digital positioner).

Instructions for performing this calibration can be found in Section 10.

3.2 Bench Check

Configure Logix 1400 Digital Positioner Before Installation

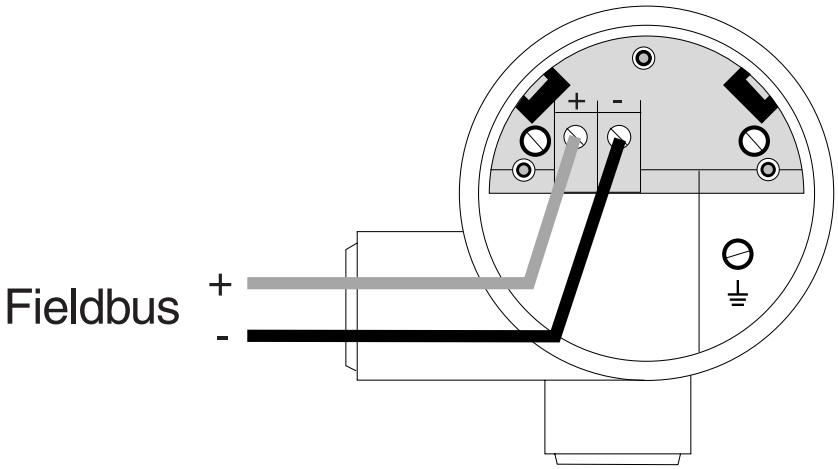
Using the NI-FBUS Configurator (or other fieldbus device configuration application), the user can perform an bench check of the Logix 1400 digital positioner before it is mounted and connected to the process hardware and the fieldbus network. By wiring the device to the fieldbus interface of a PC and using a fieldbus power supply to furnish power to the device, the user can read and write parameters in the Logix 1400 digital positioner.

1. Connect fieldbus cable to junction block fieldbus interface card to the fieldbus network.

Observe polarity of fieldbus cable throughout the network.

2. Loosen end-cap lock and remove end-cap cover from terminal block end of positioner housing.

3. Observing polarity, connect positive fieldbus lead to signal + terminal and negative fieldbus lead to signal – terminal.



Example: Connecting wiring device.

4. At the junction block, connect a fieldbus terminator in parallel with the device.
5. Connect a power supply , power conditioner (if needed) and a fieldbus terminator to the fieldbus cable.
6. Turn on PC.
7. Turn on power supply.
8. Start fieldbus configuration application on PC.
9. Establish communications.

Once communications have established between the Logix 1400 digital positioner and the PC, the user can then query the Logix 1400 digital positioner.

Assign Bus Address and Device Tag

Check the device ID of the Logix 1400 digital positioner and assign a network node address to the device and assign tag names to the device.

Note that the Logix 1400 digital positioner is shipped with default node addresses and tag names that appear at start-up. These can be changed to actual network addresses and tag names.

Typically the device tag and block tags are modified to be unique throughout the network.

Device Configuration

The user can view the various block parameters that make up the Logix 1400 digital positioner configuration. Enter parameter values for your process application and write them to the device. **Refer to the *Logix 1400 Digital Positioner Start-up Guide* in Appendix B for supplemental help.**

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Section 4: Pre-installation Considerations

4.1 Introduction

About This Section

This section reviews several topics which should be considered before installing the Logix 1400 digital positioner. If replacing an existing Logix 1400 digital positioner, this section can be skipped.

4.2 Considerations for Logix 1400 Digital Positioner

Evaluate Conditions

The Logix 1400 digital positioner is designed to operate in common indoor industrial environments as well as outdoors. To assure optimum performance, conditions at the mounting area should be evaluated relative to published device specifications and accepted installation practices for electronic positioners.

- Environmental Conditions:
  - Ambient Temperature
  - Relative Humidity
- Potential Noise Sources:
  - Radio Frequency Interference (RFI)
  - Electromagnetic Interference (EMI)
- Vibration Sources:
  - Pumps
  - Motorized Valves
- Process Characteristics:
  - Temperature
  - Maximum Pressure Rating

Figure 4.1 illustrates typical mounting area considerations to make before installing Logix 1400 digital positioner.

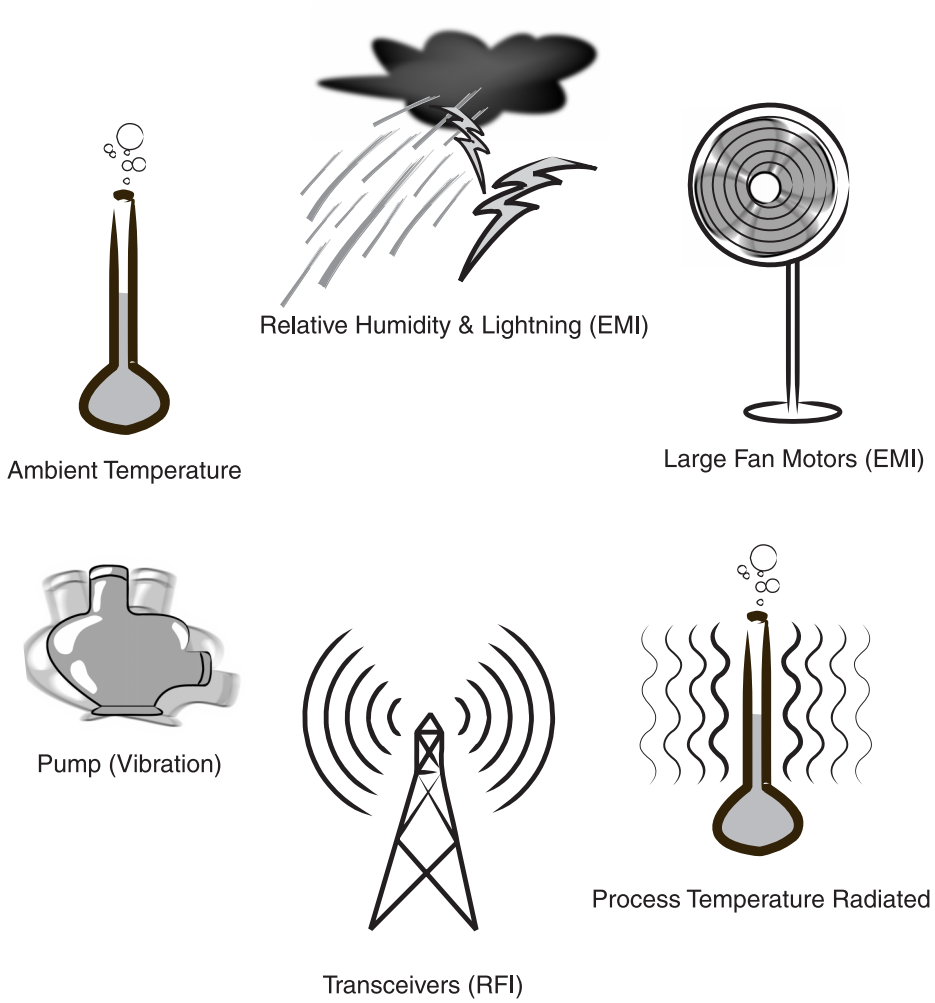

Figure 4.1 Typical Mounting Area Considerations Prior to Installation

Temperature Limits

Table 4.1 lists the operating temperature limits for Logix 1400 digital positioner.

Table 4.1 Operating Temperature Limits

	Ambient Temperature For Intrinsically Safe Applications		Electronics Ratings for Explosion-proof Applications	
	°C	°F	°C	°F
Logix 1400 digital positioner	-40 to 62	-40 to 144	-40 to 85	-40 to 185

Power Requirements

The Logix 1400 digital positioner is a bus-powered (two-wire) device, meaning that it receives its power from the VDC on a fieldbus wiring segment. Certain guidelines and limitations exists regarding the wiring of fieldbus devices. See Section 5.4 for more information on wiring the device.

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Table 4.2 lists the operating power requirements for the Logix 1400 digital positioner.

Table 4.2 Logix 1400 Digital Positioner Power Requirements

Static Power	Minimum	Maximum
	9 VDC @ 23mA	32 VDC @ 23mA

Air Supply Requirements

The Logix 1400 digital positioner requires an external air filter (preferably the Valtek coalescing air filter). The air supply should conform to ISA Standard S7.3 (with a dew point at least 18 °F (10°C) below ambient temperature, particle size below one micron, and oil content not to exceed one part per million). For a model with advanced diagnostics (Logix 141X digital positioner), the internal pressure sensors are rated for continuous operation up to 150 psig.

Minimum supply pressure for proper operation is 30 psig.

Use of a regulator is highly recommended as it aids in the use of the diagnostics feature.

Section 5: Logix 1400 Digital Positioner Installation

5.1 Introduction

About This Section

This section provides information about the mechanical and electrical installation of the Logix 1400 digital positioner. It includes procedures for mounting, piping and wiring the Logix 1400 digital positioner for operation. **Refer to *Logix 1400 Digital Positioner* IOM in Appendix C for detailed information.**

5.2 Mounting Variations

Overview

The Logix 1400 digital positioner can be mounted to a:

- Valtek control valve
- Other manufacturer's control valve

NOTE: *Figure 5.1 through Figure 5.4 show typical installations for comparison*

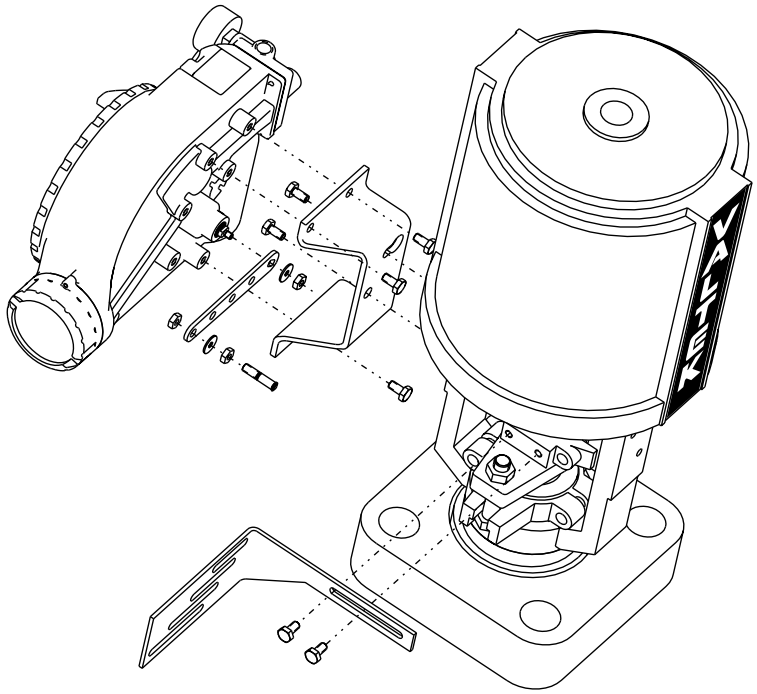

Figure 5.1 Typical Linear Actuator-mounted Installation

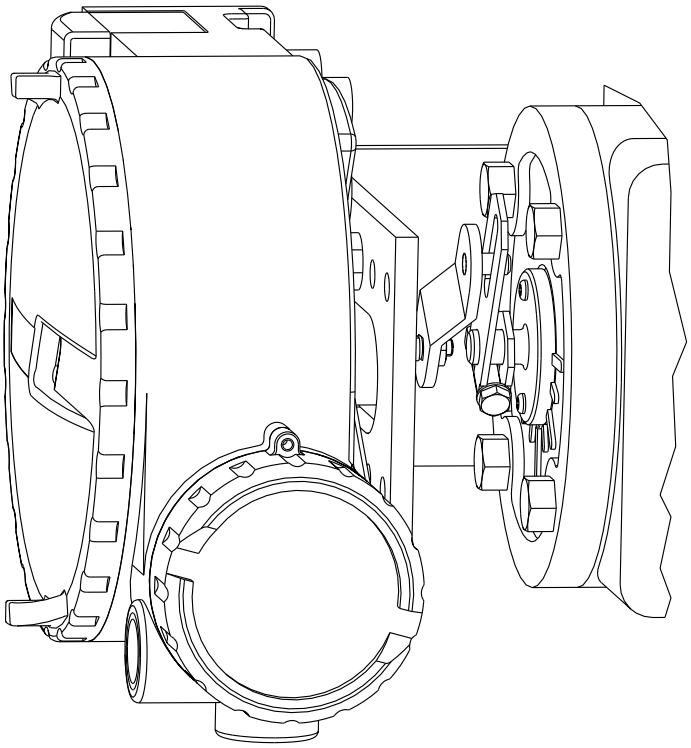

Figure 5.2 Rotary Transfer Case Mounting

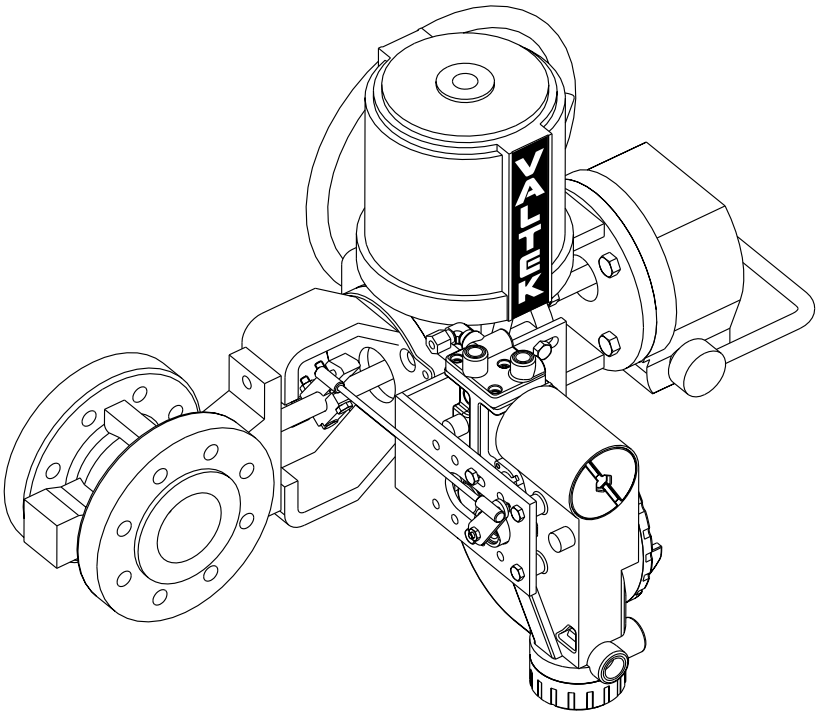

Figure 5.3 Rotary Valve with Four-bar Linkage

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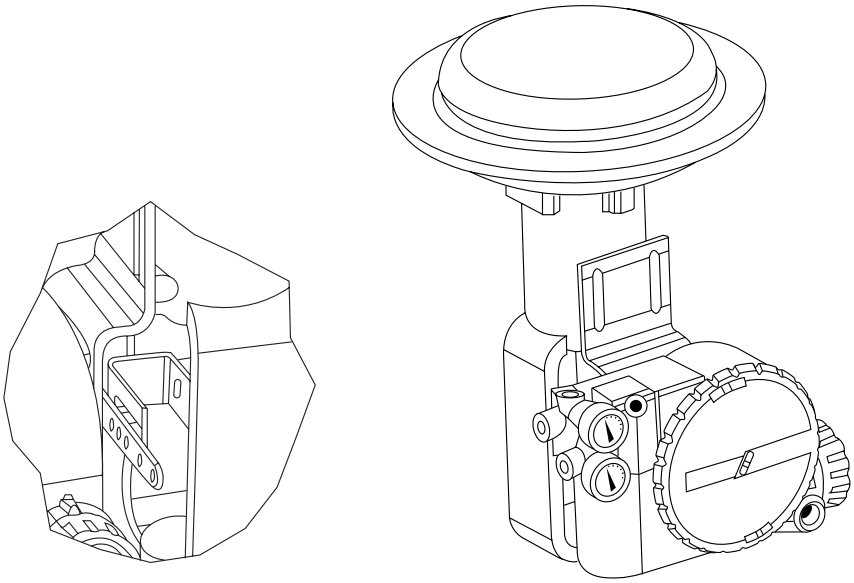

Figure 5.4 Logix 1400 Digital Positioner Mounted to a Diaphragm Actuator

5.3 Wiring Logix 1400 Digital Positioner

Wiring the Logix 1400 Digital Positioner to a Fieldbus Network

The Logix 1400 digital positioner is designed to operate in a two-wire fieldbus network. Although wiring the Logix 1400 digital positioner to a fieldbus network is a simple procedure, a number of rules exist that should be followed when constructing and wiring a network. This section provides general guidelines that should be considered when wiring the Logix 1400 digital positioner to a fieldbus network segment. A procedure is given in this section for properly wiring the Logix 1400 digital positioner.

For Detailed Fieldbus Wiring Information

Refer to Fieldbus Foundation document AG-140, *Wiring and Installation 31.25 kbit/s, Voltage Mode, Wire Medium Application Guide,* for complete information on wiring fieldbus devices and building fieldbus networks.

Fieldbus Device Profile Type

The Logix 1400 digital positioner is identified as either of the following fieldbus device profile types in Table 5.1, (as per Fieldbus document FF-816):

Table 5.1 FOUNDATION fieldbus Profile Types (1 of 2)

Device Profile Type:		Characteristic
111	113	
X	X	Uses standard-power signaling to communicate on a fieldbus network.
X	X	Is a bus-powered device. (The Logix 1400 digital positioner does not have an internal power supply and so it receives its DC power from the fieldbus.)

Table 5.1 FOUNDATION fieldbus Profile Types (2 of 2)

Device Profile Type:		Characteristic
111	**113**	
X		Is acceptable for intrinsically safe (I.S.) applications
	X	Is acceptable for non I.S. applications

If the user is installing intrinsically safe field devices in hazardous areas, several points should be considered. See Intrinsically Safe Applications section.

Logix 1400 Digital Positioner Wire Connections

Fieldbus signal communications and DC power are supplied to the Logix 1400 digital positioner using the same fieldbus twisted-pair cable.

Inside the electronics housing of the Logix 1400 digital positioner is the terminal block for connecting external wiring as shown in Figure 5.5. Table 5.2 explains the usage of the wiring terminals for fieldbus use.

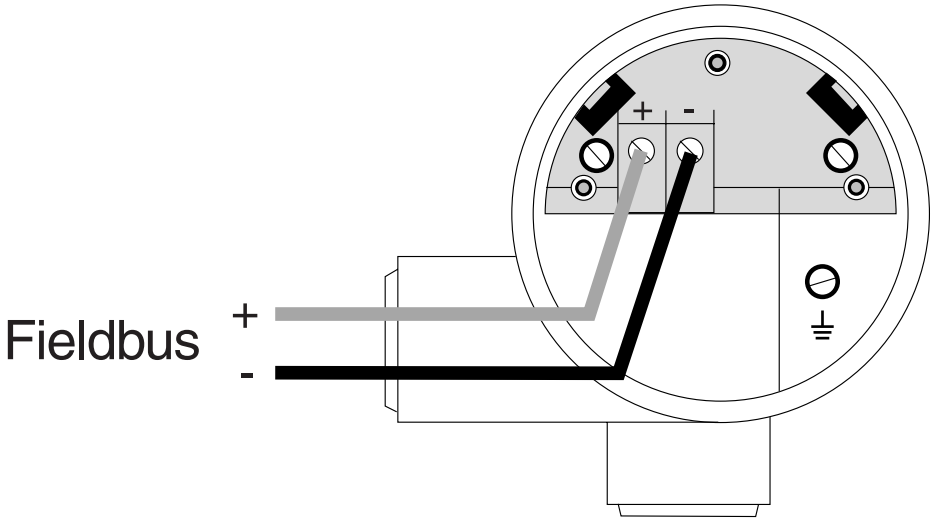

Figure 5.5 Logix 1400 Digital Positioner Terminal Block

Table 5.2 Logix 1400 Digital Positioner Wiring Terminals

Wiring Terminal		Use
Screw terminals	Signal + and -	Fieldbus cable connections
Quick clip terminals	Signal + and -	Fieldbus cable connections

Internal Ground Connection

An internal ground terminal is available next to the terminal. (See Figure 5.5.) The terminal can be used to connect the Logix 1400 digital positioner to earth ground.

External Ground Connections

While grounding the Logix 1400 digital positioner is not necessary for proper operation, an external ground terminal on the outside of the electronics housing provides additional

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noise suppression as well as protection against lightning and static discharge damage. Note that grounding may be required to meet optional approval body certification.

Intrinsically Safe Applications

Fieldbus barriers should be installed per manufacturer's instructions for Logix 1400 digital positioners to be used in intrinsically safe applications.

The Logix 1400 digital positioner carries an intrinsically safe barrier rating of 125 mA. Currents up to 125 mA will not damage the device.

The number of field devices on a segment may be limited due to power limitations in hazardous area installations. Special fieldbus barriers and special terminators may be required. Also, the amount of cable may be limited due to its capacitance or inductance per unit length.

Detailed Intrinsically Safe Information

Refer to Fieldbus Foundation document AG-163, *31.25 kbit/s Intrinsically Safe Systems Application Guide,* for detailed information on connecting fieldbus devices for intrinsically safe applications.

Logix 1400 Digital Positioner Wiring Procedure

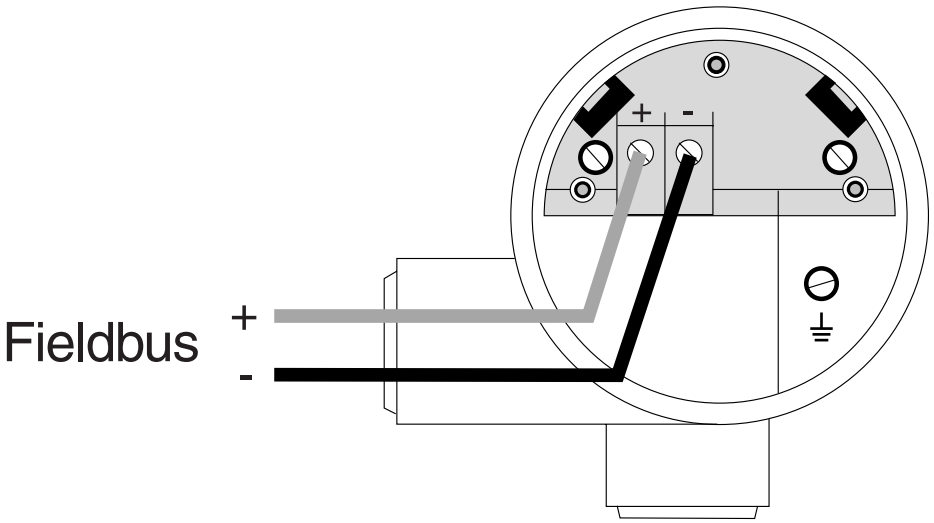
The following procedure shows the steps for connecting fieldbus cable to the Logix 1400 digital positioner.

All wiring must comply with local codes, regulations, and ordinances.

1. Loosen end-cap lock and remove end-cap cover from terminal block end of positioner housing.
2. Feed fieldbus cable through one of conduit entrances on either side of electronics housing. Plug whichever entrance not used.

The Logix 1400 digital positioner accepts up to 16 AWG (1.5 mm diameter) wire.

Observing polarity, connect positive fieldbus lead to Signal + terminal and negative fieldbus lead to Signal – terminal.



3. Connect the fieldbus cable shield (Fieldbus Cable Shield Connection). Normal practice for grounding a fieldbus cable segment is that the cable shield should be grounded in only one place - preferably a ground point at the power supply, intrinsically safe barrier or near the fieldbus interface.
4. Replace end-cap, and tighten end-cap lock.
5. Connect a flat-braided wire to the external ground screw of the Logix 1400 digital positioner housing.
6. Using the shortest length possible, connect the other end of the braided wire to a suitable earth ground.

Lightning Protection

The Logix 1400 digital positioner contains no protection against near lightning strikes. External lightning protection measures should be employed as needed.

Conduit Seal

Logix 1400 digital positioners installed as explosion-proof in a Class I, Division 1, Group A Hazardous (Classified) Location in accordance with ANSI/NFPA 70, the US National Electrical Code (NEC), require a 'LISTED' explosion-proof seal to be installed in the conduit, within 18 inches of the Logix 1400 digital positioner.

Crouse-Hinds® type EYS/EYD or EYSX/EYDX are examples of 'LISTED' explosion-proof seals that meets this requirement.

Logix 1400 digital positioners installed as explosion-proof in a Class I, Division 1, Group B, C or D Hazardous (Classified) Locations do not require an explosion-proof seal to be installed in the conduit.

NOTE: Installation should conform to all national and local electrical code requirements.

Do not install in a Hazardous Location without following industry guidelines.

Electrical Wiring Summary

Verify polarity when making field termination connection. The Logix 1400 digital positioner is reverse polarity protected. With a fieldbus power supply connected, verify that an LED is blinking to determine if the electronics are running. Only one LED will blink at any given time.

Electrical Wiring Frequently Asked Questions

Question: My DCS uses 24VDC, can I run a Logix 14xx?
Answer: FF specifies a 9-32V operation range. A fieldbus compatible power supply with terminators should be used. NOTE: The Logix 14xx is driven from a voltage source, not the typical 4-20 mA supply.

Question: I accidentally reversed the voltage supply across the Logix 1400 digital positioner. How do I know if I damaged something.
Answer: The Logix 14xx is reverse polarity protected. Inadvertent connection of the fieldbus supply shouldn't damage the unit.

Question: What is the input resistance of the Logix 1400 digital positioner?
Answer: The Logix 1400 digital positioner does not have a simple resistive input. This is because the Logix 1400 digital positioner is an active device. The fieldbus specifications dictate that the input impedance cannot be less than 3k ohms. This will vary according to frequency of the fieldbus communications. Typical power requirements are 23 mA @ 9-32 VDC.

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Note: The user cannot measure across the terminals of an un-powered Logix 14xx digital positioner and get the effective resistance. It is an impedance device, not a resistive device.

5.4 Powering Up the Logix 1400 Digital Positioner

Pre-power Checklist

Before applying power to the fieldbus network the user should make the following checks:

- Verify that the Logix 1400 digital positioner has been properly mounted and connected to a system.
- The Logix 1400 digital positioner has been properly wired to a fieldbus network.
- The Logix 1400 digital positioner housing has been properly connected to a suitable earth ground.
- The operator station or host computer has been installed and connected to the fieldbus network.

NOTE: If the user wants to enable the write-protect feature or change the operating mode of the Logix 1400 digital positioner to simulation mode, the user must change hardware jumpers on the internal electronics boards. This requires that the power be removed from the Logix 1400 digital positioner. See Section 6.5, *Setting Write-protect Feature,* on page 28 and Section 10.8, *Simulation Mode,* on page 116 for details.

Power Up Procedure

To apply power to the fieldbus network, perform the following steps:

1. Turn on all power supplies that furnish DC power to the fieldbus network.
2. Use a digital voltmeter and measure the DC voltage across the + and - Signal terminals of the Logix 1400 digital positioner. Verify polarity.
3. Verify that the terminal voltage is within the limits listed in Table 4.2, *Logix 1400 Digital Positioner Power Requirements,* on page 15.

Section 6: Logix 1400 Digital Positioner Configuration

6.1 Introduction

About This Section

This section explains the tasks to establish communications and configure the Logix 1400 digital positioner for the process application. An overview is given of the configuration tasks using the NI-FBUS Configurator application as an example. Detailed information on using the configurator application is found in the user manual supplied with the software.

Before proceeding with the tasks in this section the Logix 1400 digital positioner must be installed and wired correctly. The user should be somewhat familiar with the fieldbus configuration.

If the Logix 1400 digital positioner has not been installed and wired, or if the user is not familiar with device configuration, and/or does not know if the Logix 1400 digital positioner is configured, please read the other sections of this manual before configuring the Logix 1400 digital positioner.

6.2 Logix 1400 Digital Positioner Communications

Communications and Control

All communications with the Logix 1400 digital positioner is through an operator station or host computer running supervisory control and monitoring applications. These applications provide the operator interface to fieldbus devices and the fieldbus network.

Configuration Applications

Configuration of the Logix 1400 digital positioner for the process application is performed also through the operator interface (operator station or PC) running a fieldbus configuration software application.

A number of applications are available for the user to configure fieldbus devices. The examples presented in this manual refer to the NI-FBUS Configurator application.

Software Compatibility

The NI-FBUS Configurator application version specified in Section 1.1 is fully compatible with all Valtek control products with FOUNDATION fieldbus communications option.

6.3 Logix 1400 Digital Positioner Configuration Process

Logix 1400 Digital Positioner Configuration

Configuration of the Logix 1400 digital positioner (device) involves the following steps:

1. Establishing communication between the operator interface and the device (bringing the Logix 1400 digital positioner on-line in a fieldbus network). See Section 6.7, *Establishing Communications,* on page 30.
2. Making initial checks on the device serial number and firmware revision numbers. See Section 6.8, *Making Initial Checks,* on page 31.
3. Using a fieldbus configuration application, creating or making changes to the device configuration. See Section 6.9, *Configuration Tasks,* on page 32.
4. Writing the device configuration changes to the device. See Section 6.9, *Configuration Tasks,* on page 32.
5. Saving device configuration to disk. See Section 6.9, *Configuration Tasks,* on page 32.

6.4 Device Configuration

Function Block Application Process

All fieldbus devices contain one or more Function Block Application Processes (FBAP) as part of their device configuration. The FBAP in the Logix 1400 digital positioner is a software application that defines the particular characteristics of the Logix 1400 digital positioner. The FBAP comprises function blocks, a transducer block and a resource block, plus other functions which support these blocks. Each function block contains a set of operating parameters (some of which can be user-configured) that define the operating characteristics of the Logix 1400 digital positioner.

Function blocks perform (or execute) their specific functions according to a schedule. This schedule provides the sequence and timing of events which occur within a device and also between other fieldbus devices. This schedule is coordinated with the function block execution schedules in the device and other fieldbus devices on the network.

Additional information on the FBAP contained in the Logix 1400 digital positioner is found in Section 8, Device Configuration.

Fieldbus Configuration Application

The Logix 1400 digital positioner is configured using a fieldbus configuration application running on a operator station or host computer. The configuration tool allows the user to:

Connect function block inputs and outputs according to the process requirements.

- Make changes to function block parameters according to the process requirements
- Make changes to the schedule of function block execution.
- Write the FBAP changes to the device.

Mechanical Configuration Issues

Air Action Air-to-open and Air-to-close are determined by the actuator tubing, not the software. When air action selection is made during configuration, the selection is telling the control which way the actuator is tubed. The tubing should be verified as correct prior to a stroke calibration. The top output port on the positioner is called *output 1*. It should be tubed to the increase open side of the actuator. That is, for an air-to-open actuator, *output 1* should go to the bottom of the actuator.

Linear vs. Rotary The positioner has two configuration settings: Linear and Rotary. In order to get better resolution, stem position sensor gains are adjusted based on the

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angle of rotation of the linkage. The linear setting allows for linkage rotation up to 65°. The rotary setting allows for linkage rotation up to 95°. These settings only determine the angle of sensor rotation and do not affect control parameters. If a positioner is set to linear linkage and a red LED blinks after calibration, the most common cause is that the sensor movement was greater than 65°. This can occur if the roller pin was placed in the wrong hole on the follower arm or the stem clamp is placed too high. The take-off arm should always be level with the stem clamp on linear mountings.

The Logix 14xx positioner has an electrical measurement range of 100°. That is, the electronics will sense stem position over a 100° range of travel of the follower arm. On a rotary valve, the typical rotation is 90°. When installing a Logix 14xx positioner on a rotary valve, the 90° valve rotation must be centered within the 100° electrical range. If mechanical movement falls outside the electrical measurement range, the positioner can have a dead band at one end of travel in which valve movement cannot be sensed.

Question: How do I know if the rotary linkage is centered within the 100° electrical range?
Answer: The slot in the take-off arm has enough clearance around the roller pin to move the follower arm slightly. Move the valve to the fully closed position. At this position, move the follower arm within the slot clearance. If the valve does not respond to the movement; linkage adjustment is necessary. Repeat this test at the fully open position.

To adjust the stem position linkage, use the *A/D feedback* variable viewed using AD_RAW_FB parameter. Set TEST_MODE bit 'Enable diagnostic Variable access.' With the valve in its mechanical fail position (i.e. no pressure applied), slightly move the follower arm while watching the A/D feedback. If the number does not change, the arm is not centered in the electrical range. (The number will bounce one or two counts due to noise at a fixed position and should not be considered a change, it should move greater than 10 to 20 counts if the linkage is centered correctly). Rotate the take-off arm, if necessary, to bring the linkage in range. This procedure is only necessary on a rotary mounting. For Linear mountings, the red LED will blink if 65° travel is exceeded. Refer to the Calibration section for further information on stroke calibration errors.

Default Configuration

An FBAP containing default configuration parameters is resident in the firmware of the device and is loaded on power-up. By using the NI-FBUS Configurator (or other fieldbus configuration) application, the user can create or make changes to a FBAP for the device's process application.

Device Configuration

Configuring the Logix 1400 digital positioner results in:

- Function blocks that execute according to a user-defined schedule
- Measurements that are processed according to various user-configured parameters found within function blocks
- An output published on the fieldbus network according to a user-defined publishing schedule.

Device Configuration Example

A sample printout of a typical device configuration for the Logix 1400 digital positioner is given in Appendix A, *Sample Configuration Record,* on page 135.

LAS Capability

The Logix 1400 digital positioner is capable of operating as the Link Active Scheduler (LAS). The LAS is a fieldbus device which controls traffic on the network, such as controlling token-rotation and coordinating data publishing. This fieldbus function is active in only one device at any given time on a network. Devices which can be designated as the LAS may be an operator station or a field device. The Logix 1400 digital positioner can

be designated as a LAS so that, in the event of a failure of the *primary* LAS, control in the field could continue.

Please note that the Logix 1400 digital positioner in not designed to be the primary LAS, and, therefore, the LAS capability in the positioner is regarded as a backup LAS. In some remote applications where there is no host computer continuously connected this device may be configured as the primary LAS.

Special Non-volatile Parameter and NVM Wear Out

All function block parameters designated as non-volatile (N) in the FF specifications are updated to non-volatile memory (NVM) on a periodic basis. NV_CYCLE_T parameter in the resource block specifies this update interval.

To provide predictable restart behavior in the transmitter, the following non-volatile parameters are updated to NVM each time they are written over the fieldbus.

- MODE.TARGET for all blocks
- SP.VALUE for the PID block

Since these are user-written parameters, additional updates to NVM contribute negligibly to NVM wear-out. However, users are cautioned not to construct control configurations where the above parameters are written continuously (via a computer application for example) or at rates greater than the NV_CYCLE_T interval. This consideration will help minimize the possibility of NVM wear-out.

In the case of MODE, this should not be a problem. When users wish to provide set-points to the PID block via a computer application, users should use RCAS mode with its corresponding set-point value RCAS_IN. RCAS_IN is updated only at the NV_CYCLE_T update rate and this mode supports full shedding functionality and PID initialization necessary for a robust application.

6.5 Setting Write-protect Feature

Write-protect Feature

The Logix 1400 digital positioner is available with a write protect feature. It consists of a jumper located on the device's electronics board that can be set to enable read only access (write-protect) to the device's configuration. When the jumper is in the read only (R) position and the corresponding device parameter is set, the device's configuration parameters and calibration data can only be read or viewed, (device configuration is write protected).

The jumper is factory set for read- and write-access (not write-protected) W position. (If the jumper is in the R position, the positioner must be powered down before changing the jumper.)

NOTE: The write protect jumper is used in conjunction with the FEATURE_SEL parameter and is explained below.

Refer to the following steps to set the write protect jumper.

1. Remove power to Logix 1400.
2. Loosen cap lock and unscrew end main housing cover of housing.
3. Using a ground strap or ionizer is highly recommended when handling the electronics module, because electrostatic discharges can damage certain circuit components.
4. Locate the jumpers on the main electronic boards in the housing.

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5. Set write-protect jumper to the appropriate position on the electronics board. See Figure 6.1 and Table 6.1.
6. Replace the cover and lock the locking screw.

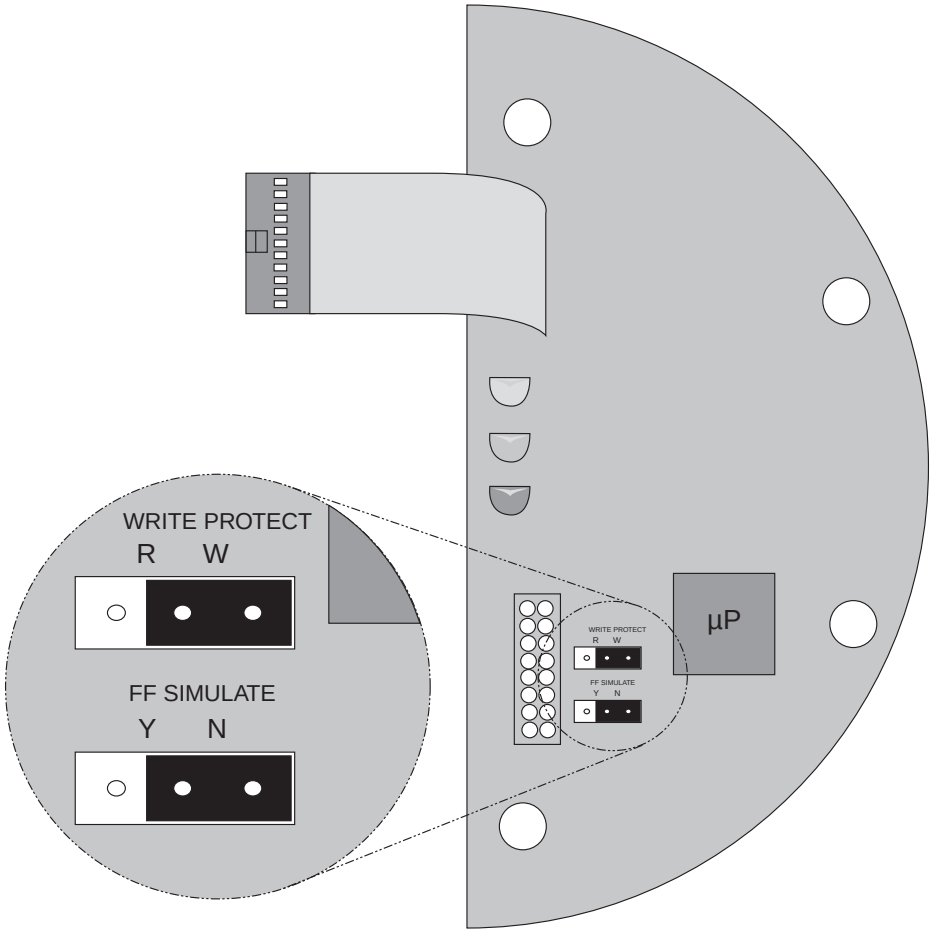
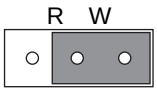
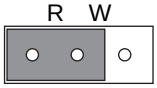


Figure 6.1 Write-protect Jumper Location on Controller Board

Table 6.1 Write Protect Jumper Settings

To	Set the Jumper to:
Enable read and write access to the device's configuration. (Factory-set default)	W position on the transducer board. 
Enable read only access to device's configuration. (Write-protect)	R position on the transducer board.* 

* FEATURE_SEL parameter must also be set accordingly to enable write protect. (Set FEATURE_SEL = Hard W Lock in the Resource Block)

Enabling Write Protect Feature

The write-protect feature is activated only when the HARD_W_LOCK option is set in the FEATURE_SEL parameter. Once the bit is set and W/R jumper is in R position, the device will remain write-protected until the device is powered down and the jumper is placed in the W position. See Table 6.2 for truth table.

Table 6.2 Write-protect Feature Truth Table

When the Write-protect jumper on controller board is set to:	... and the FEATURE_SEL HARD_W_LOCK option is set to: 0 (No) 1 (Yes)	
W position	Write-protect Disabled	Write Protect Disabled
R position	Write-protect Disabled	Write Protect Enabled

6.6 Simulation Jumper

Simulation Jumper

A simulation parameter in the AO block is used to aid in system 'debug' if the process is not running. A hardware jumper is provided to enable or disable the simulate parameter. See Section 10.8 for details on setting the simulation jumper. (See Figure 6.1.)

6.7 Establishing Communications

Starting Communications

Once the Logix 1400 digital positioner is connected to the fieldbus network and powered up, the user is ready to start communicating with the device.

The procedure in Table 6.3 outlines the steps to initiate communications with a Logix 1400 digital positioner using the NI-FBUS Configurator.

Table 6.3 Starting Communications with Logix 1400 Digital Positioner

Step	Action
1. Check that the fieldbus is powered up.	Verify that the power supply is on and connected with the proper polarity. See Table 4.2, *Logix 1400 Digital Positioner Power Requirements,* on page 15 for proper voltage levels.
2. Verify that the operator interface is loaded with the NI-FBUS Configurator or other configuration application.	Start the application on the computer.
3. View the active devices connected to the network.	Start the NI-FBUS fieldbus driver and Configurator. ***NOTE:*** *If the device is not on the list of active devices, check to make sure that the correct polarity is observed on the fieldbus cable connection to the device terminal block. If the polarity is reversed, no damage will result, the device simply will not work.*
4. Access the Logix 1400 digital positioner's blocks and parameters.	Start the NI-FBUS Configurator application.

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Tag Name Assignments

If device or block tags have not been assigned to a device, the NI-FBUS Configurator will automatically assign a default device tag name. This is done so that the devices are visible on the network. The user can then change tag names according to the process requirements.

6.8 Making Initial Checks

Identifying the Logix 1400 Digital Positioner

Before proceeding, verify the following to make sure that the user is communicating with the correct Logix 1400 digital positioner:

- Device type
- Device ID = 464C530202-VAL-LX1400-00nnnnnnnn
- Device tag, (tag description of the Logix 1400 digital positioner)
- Firmware revision level (revision level of the firmware elements)

Table 6.4 lists the block parameters for quickly identifying the Logix 1400 digital positioner.

Table 6.4 Logix 1400 Digital Positioner Identification

Step	View Parameter	Verify
1	RS.DEV_TYPE	The Logix 1400 digital positioner is the proper device type: For the Logix 1400 digital positioner, the value is = 0x0202
2	RS.REVISION_ARRAY REVISION_ARRAY = REVISION_ARRAY = REVISION_ARRAY =	The revision number of the: Fieldbus board firmware Fieldbus board boot code Positioner board firmware ***NOTE:*** *These numbers are helpful when troubleshooting the device.*
3	Physical Device Tag ***NOTE:*** *The device tag name is not contained in a parameter. It can be set and viewed using the fieldbus device configurator application.*	The physical device tag is correct.

6.9 Configuration Tasks

Device Configuration Procedure Overview

A typical device configuration consists of the following tasks listed in Table 6.5 using the NI-FBUS Configurator application. Details on using the configurator application are found in the NI-FBUS Configurator user manual supplied with the application software.

This procedure assumes that the hardware installation of the Logix 1400 digital positioner is complete and the Logix 1400 digital positioner is powered up.

Table 6.5 Logix 1400 Digital Positioner Configuration Task List

Task	Procedure	Result
1	Start the fieldbus process application	Scans the fieldbus network and provides a listing of all active fieldbus devices on the network or selected link.
2	Start the fieldbus configurator application	Configurator windows are displayed on screen listing the active fieldbus devices.
3	Select a fieldbus device for configuration	
4	Change the device and block tags, if desired.	Any unassigned tags are given a default tag name by the configurator.
5	Select/add/edit function blocks to create a function block application process. **NOTE:** Configure block objects in the following order: **1.** Resource block **2.** Transducer block **3.** Analog Output block **4.** PID block	Shows a representation of function blocks in the graphical interface window.
6	Connect (or wire) function blocks to define process loops.	Linkages between function block inputs and outputs are created by using wiring tools. Pre-configured templates can also be used.
7	Change block parameters, if necessary.	Parameters changed for the process requirements.
8	Configure trends and alarms	Trending and alarms configured according to the process requirements.
9	Adjust the block execution schedule.	The function block execution schedule changed according to the process requirements.
10	Write configuration to the fieldbus network.	The configuration changes are sent to the appropriate fieldbus devices on the network.
11	Save the device configuration to disk.	A copy of the device configuration file is saved on the hard disk of the computer or other disk.

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Section 7: Operation

7.1 Introduction

About This Section

This section outlines the tasks for operating and monitoring the Logix 1400 digital positioner on a fieldbus network. Refer to the *Logix 1400 Digital Positioner Start-up Guide*, for additional information.

7.2 Operation Tasks

Fieldbus Device Operations

Positioning For the most basic operation of the Logix 1400 digital positioner the user must write the desired final position value to OUT in the AO block. The AO block MODE_BLK would be set to Manual. The AO block SHED_OPT must be set to anything but uninitialized and the CHANNEL is set to1. The Transducer block MODE_BLK is set to Auto. The Resource block MODE_BLK is set to Auto.

Calibration Set the AO block and Resource block as above. Next set the Transducer block MODE_BLK to Out-of-Service (OOS). Write the desired calibration to CALIBRATE to perform the calibration routine. If performing the actuator pressure transducer calibration, the user will need to first write the supply pressure value into PRESS_CAL in psig.

Section 8: Configuration Description

8.1 Introduction

About This Section

This section provides information about the construction and contents of the Logix 1400 digital positioner Function Block Application Process (FBAP) — the application that defines Logix 1400 digital positioner function and operation in the process application.) This information provides some understanding of the elements that make up the configuration of the device application.

For More Information on FBAP

The FBAP elements are described as they apply to the Logix 1400 digital positioner in the following sections. More detailed information can be found in Fieldbus Foundation documents FF-890 and FF-891 *Foundation Specification Function Block Application Process* (Parts 1 and 2).

8.2 Function Block Application Process

Introduction

The FBAP comprises a set of elementary functions which are modeled as function blocks. Function blocks provide a general structure for defining different types of device functions (such as analog inputs, analog outputs and PID control).

The FBAP also contains other objects that provide other device functions, such as furnishing alarm information, historical data and links to other blocks for transferring data.

FBAP Elements

The key elements of the FBAP are:

- Logix block objects and their parameters (and consist of the following block types)
  - Resource block
  - Transducer block
  - PID Function block
  - AO Function block
- Link Objects
- Alert Objects
- Trend Objects
- View Objects
- Domain Objects

Device Objects

Link objects allow the transfer of process data from one block to another. View, Alert and Trend objects handle function block parameters for operator interface of views, alarms and events, and historical data. A brief description of these objects is presented in the following sections.

8.3 Block Description

Block Objects

Blocks are elements that make up the FBAP. The blocks contain data (block objects and parameters) that define the application, such as the inputs and outputs, signal processing and connections to other applications. The Logix 1400 digital positioner application contains the following block objects:

- Resource block
- Transducer block
- Analog Output (AO) function block
- Proportional Integral Derivative (PID) controller function block

Table 8.1 briefly describes the operation of these blocks.

Table 8.1 Function Block Application Process Elements

Block Type	Function
Resource	Contains data which describes the hardware (physical) characteristics of the device. The resource block does not perform any action, but contains parameters that support application downloads.
Transducer	Isolates the function blocks from I/O devices such as sensors, actuators and switches. The transducer block interfaces with the hardware to produce an output. It also contains device-specific parameters, such as calibration and diagnostics parameters.
Analog Output (AO) function block	Performs basic automation functions that are integral to automated control and processing operations. The AO block performs functions like engineering units scaling, output scaling, alarming, and back calculation, when connected as a cascade to a PID or other block
PID Controller function block	Performs standard or robust proportional integral derivative algorithm used in closed-loop processing.

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FBAP Block Diagram

Figure 8.1 shows the important elements of the Logix 1400 digital positioner FBAP. Many parameters are omitted for clarity.

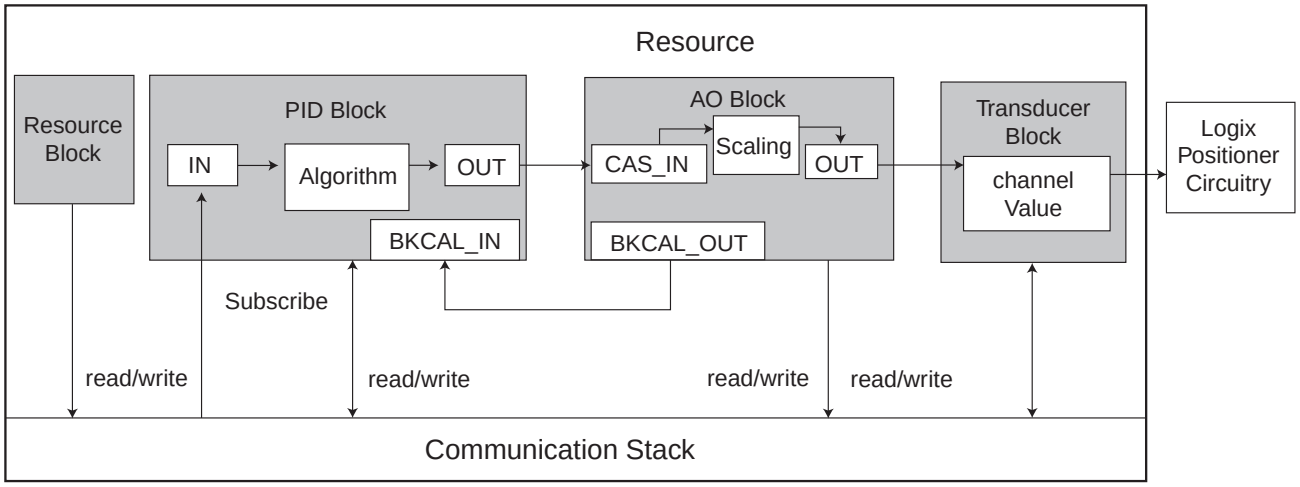

Figure 8.1 FBAP Block Diagram Example

Block Descriptions

Each block contains parameters that are standard Fieldbus Foundation-defined parameters. In other words, the parameters are pre-defined as part of the FF protocol for all fieldbus devices. Additionally, parameters exist which are defined by Flowserve and are specific to the Valtek Logix 1400 digital positioner.

The following block descriptions list the predefined FF parameters included as part of the block as well as the Flowserve-defined parameters. A complete description for the FF parameters is provided in the Fieldbus Foundation document FF-891, *Foundation Specification Function Block Application Process Part 2*. The Flowserve parameter descriptions are included here as part of the block descriptions.

Block Parameter Column Descriptions

Tables on the following pages list all of the block parameters contained in each of the block objects. Table 8.2 explains the column headings for the parameter listings.

Table 8.2 Block Parameter List Column Description

Column Name	Description
Index	A number that corresponds to the sequence of the parameter in the block parameter segment of the object dictionary. See Object Dictionary, Section 8.16.
Name	The mnemonic character designation for the parameter.
Data Type / Structure	Data type or structure for the parameter value: **1.** Data types consist of simple variables or arrays and are: • **Unsigned8, Unsigned16 Unsigned32** - An unsigned variable of 8, 16 or 32 bits. • **Floating point** - Floating point variable. • **Visible string** - Visible string variable. • **Octet string** - Octet string variable. • **Bit string** - Bit string variable. **2.** Data Structures consist of a record which may be: • **Value and Status - float** - Value and status of a floating point parameter. • **Scaling** - Static data used to scale floating point values for display purposes. • **Mode** - Bit strings for target, actual, permitted and normal modes. • **Access permissions** - Access control flags for access to block parameters. • **Alarm - float** - Data that describes floating point alarms. • **Alarm - discrete** - Data that describes discrete alarms. • **Event - update** - Data that describes a static revision alarm. • **Alarm - summary** - Data that summarizes 16 alerts. • **Simulate - Float** - Simulate and transducer floating point value and status, and a simulate enable/disable discrete. • **Test** - Function block test read/write data.
Store	Indicates the type of memory where the parameter is stored: **S** - Static — Writing to the parameter changes the static revision counter parameter ST_REV **N** - Non-volatile — Parameter must be retained during a power cycle. It is not under the static update code. **D** - Dynamic — The value is calculated by the block, or read from another block.
Default Value	Default values for the block parameters. These are the values that are used when: • the FBAP is initialized for the first time, or • selecting restart with defaults of the resource block parameter RESTART.

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8.4 Resource Block

Resource Block Function

The resource block contains data and parameters related to overall operation of the device and the FBAP. Parameters that describe the hardware specific characteristics of the device and support application download operations make up the resource block.

Resource Block Parameters

Table 8.3 lists the FF and Flowserve-defined parameters and their default values contained in the resource block.

Table 8.3 Resource Block Parameters (1 of 2)

Index	Name	Data Type/Structure	Store	Default Value
1	ST_REV	Unsigned16	S	0
2	TAG_DESC	Octet string	S	all blanks
3	STRATEGY	Unsigned16	S	0
4	ALERT_KEY	Unsigned8	S	0
5	MODE_BLK	Mode	MIX	Target = OOS*
6	BLOCK_ERR	Bit string	D	
7	RS_STATE	Unsigned8	D	
8	TEST_RW	Test	D	
9	DD_RESOURCE	Visible string	S	
10	MANUFAC_ID	Unsigned32	S	464C54
11	DEV_TYPE	Unsigned16	S	0202
12	DEV_REV	Unsigned8	S	
13	DD_REV	Unsigned8	S	
14	GRANT_DENY	Access permissions	N	0
15	HARD_TYPES	Bit string	S	
16	RESTART	Unsigned8	D	
17	FEATURES	Bit string	S	
18	FEATURE_SEL	Bit string	S	0
19	CYCLE_TYPE	Bit string	S	scheduled
20	CYCLE_SEL	Bit string	S	0
21	MIN_CYCLE_T	Unsigned32	S	4000
22	MEMORY_SIZE	Unsigned16	S	
23	NV_CYCLE_T	Unsigned32	S	28800000
24	FREE_SPACE	Floating point	D	
25	FREE_TIME	Floating point	D	
26	SHED_RCAS	Unsigned32	S	640000
27	SHED_ROUT	Unsigned32	S	640000
28	FAULT_STATE	Unsigned8	N	clear
29	SET_FSTATE	Unsigned8	D	
30	CLR_FSTATE	Unsigned8	D	
31	MAX_NOTIFY	Unsigned8	S	8

Table 8.3 Resource Block Parameters (2 of 2)

Index	Name	Data Type/Structure	Store	Default Value
32	LIM_NOTIFY	Unsigned8	S	8
33	CONFIRM_TIME	Unsigned32	S	540000
34	WRITE_LOCK	Unsigned8	S	not locked
35	UPDATE_EVT	Event - update	D	
36	BLOCK_ALM	Alarm - discrete	D	
37	ALARM_SUM	Alarm - summary	MIX	
38	ACK_OPTION	Bit string	S	0
39	WRITE_PRI	Unsigned8	S	0
40	WRITE_ALM	Alarm - discrete	D	
Valtek Device Products Parameters				
41	DL_CMD1	Unsigned8	D	
42	DL_CMD2	Unsigned8	D	
43	DL_APPSTATE	Unsigned16	S	
44	DL_SIZE	Unsigned32	S	
45	DL_CHECKSUM	Unsigned16	S	
46	REVISION_ARRAY	Unsigned32	S	
47	BLOCK_TEST	Unsigned8	D	
48	ERROR_DETAIL	Unsigned16	D	

* OOS = Out-of-service

Resource Block Valtek Product-defined Parameter Descriptions

Table 8.4 describes the Valtek product-defined parameters in the resource block, which are used during the application download procedure.

Table 8.4 Resource Block Parameter Descriptions (1 of 2)

Name	Description or Parameter Contents
DL_CMD1 DL_CMD2	Used to unlock or access the domain (flash memory area) of the device for download. Entering a series of values in these two parameters changes the internal state of the device so that it will accept the downloaded application software. The download cannot begin until the device is put into the correct internal state. The internal state of the device is read in the DL_APPSTATE parameter.
DL_APPSTATE	Contains the state of the downloaded(ing) application.
DL_SIZE	Contains the size of the downloaded application. (This will always be an even number.)
DL_CHECKSUM	Contains the 16-bit check-sum of the downloaded application.

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Table 8.4 Resource Block Parameter Descriptions (2 of 2)

Name	Description or Parameter Contents
REVISION_ARRAY	A read-only parameter that contains the application firmware revision level for: Fieldbus board application Fieldbus board boot code Positioner board application.
BLOCK_TEST	An internal Valtek product test parameter.
ERROR_DETAIL	An internal Valtek product parameter array, which contains details of BLOCK_ERR conditions.

8.5 Transducer Block

Transducer Block Function

The transducer block de-couples (or insulates) function blocks from local I/O devices, such as sensors or actuators. In the Logix 1400 digital positioner, the transducer block takes the position from the analog output block and sends it, along with other parameters, to the positioner subsystem.

Transducer Block Parameters

Table 8.5 lists the FF and Valtek product-defined parameters and their default values in the transducer block.

Table 8.5 Transducer Block Parameters (1 of 5)

Index	Fieldbus Parameter Name	Fieldbus Datatype	Storage	Read/ Write	Access Type	Notes, Default Values
1	ST_REV	Unsigned16	S	R		FF Parameter, 0
2	TAG_DESC	Octet String	S	R/W		FF Parameter, blanks
3	STRATEGY	Unsigned16	S	R/W		FF Parameter, 0
4	ALERT_KEY	Unsigned8	S	R/W		FF Parameter, 1
5	MODE_BLK	DS-69	Mixed	R/W		FF Parameter, OOS
6	BLOCK_ERR	Bit String	D	R		FF Parameter
7	UPDATE_EVT	DS-73	D	R		FF Parameter
8	BLOCK_ALM	DS-72	D	R/W		FF Parameter
9	TRANSDUCER_DIRECTORY	Unsigned16	N	R		FF Parameter
10	TRANSDUCER_TYPE	Unsigned16	N	R		FF Parameter
11	XD_ERROR	Unsigned8	D	R		FF Parameter
12	COLLECTION_DIRECTORY	Unsigned32	N	R		FF Parameter
13	FINAL_VALUE	DS_65	N	R/W*	Std	Write restricted to AO OOS
14	FINAL_VALUE_RANGE	DS-68	S	R/W		FF Parameter
15	FINAL_VALUE_CUTOFF_HI	float	S	R/W*	Info-1	110
16	FINAL_VALUE_CUTOFF_LO	float	S	R/W*	Info-1	1
17	FINAL_POSITION_VALUE	DS_65	N	R	Std	
18	SERVO_GAIN	float	S	R/W		Not used
19	SERVO_RESET	float	S	R/W		Not used

Table 8.5 Transducer Block Parameters (2 of 5)

Index	Fieldbus Parameter Name	Fieldbus Datatype	Storage	Read/ Write	Access Type	Notes, Default Values
20	SERVO_RATE	float	S	R/W		Not used
21	ACT_FAIL_ACTION	Unsigned8	S	R		Not used – see FAIL_MODE
22	ACT_MAN_ID	Unsigned8	N	R/W		FF Parameter
23	ACT_MODEL_NUM	Visible String	N	R/W		FF Parameter
24	ACT_SN	Visible String	N	R/W		FF Parameter
25	VALVE_MAN_ID	Unsigned8	N	R/W		FF Parameter
26	VALVE_MODEL_NUM	Visible String	N	R/W		FF Parameter
27	VALVE_SN	Visible String	N	R/W		FF Parameter, FLWSERVE
28	VALVE_TYPE	Unsigned8	N	R/W		FF Parameter
29	XD_CAL_LOC	Visible String	S	R/W		FF Parameter
30	XD_CAL_DATE	Visible String	S	R/W		FF Parameter, Original type “Date” is Y2K compatible
31	XD_CAL_WHO	Visible String	S	R/W		FF Parameter
Manufacturer Specific Parameters — Owned by Logix Control Processor						
32	DAC_PERCENT	float	D	R	Std	
33	CONTROL_FLAGS	Bit String (Unsigned8)	S	R/W*	Std	
34	GAIN_UPPER	float	S	R/W*	Info-1	2
35	GAIN_LOWER	float	S	R/W*	Info-1	1
36	GAIN_MULT	float	S	R/W*	Info-1	0.05
37	IGAIN	Integer16	N	R/W*	Info-1	10
38	IL_OFFSET	float	N	R/W*	Diag	55
39	STATUS_FLAGS	Bit String (Unsigned8)	N	R	Std	
40	CMD_USED	float	D	R	Std	
41	CALIBRATE	Unsigned8	D	R/W*	Std	
42	DAC_VALUE	Unsigned16	D	R/W*	Diag	
43	PRESS_CAL	float	N	R/W	Info-1	60
44	CALIBRATE_FLAGS	Bit String (Unsigned8)	D	R	Std	
45	SOFTSTOP_HIGH	float	S	R/W*	Info-1	110
46	SOFTSTOP_LOW	float	S	R/W*	Info-1	-10
47	CYCLE_COUNTER	Unsigned32	N	R/W	Std	
48	CYCLE_DEADBAND	float	S	R/W	Info-1	20
49	CYCLE_LIMIT	Unsigned32	S	R/W	Info-1	4294967294
50	TRAVEL_ENG	float	N	R/W	Std	
51	TRAVEL_DEADBAND	float	S	R/W	Info-1	20
52	TRAVEL_ALERT	float	S	R/W	Info-1	2e+ 006
53	STROKE_ENG	float	N	R/W	Info-1	1

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Table 8.5 Transducer Block Parameters (3 of 5)

Index	Fieldbus Parameter Name	Fieldbus Datatype	Storage	Read/ Write	Access Type	Notes, Default Values
54	TRAVEL_UNITS	Unsigned8	S	R/W	Info-1	Inches
55	CURVEX	Float[21]	S	R/W*	Info-4	
56	CURVEY	Float[21]	S	R/W*	Info-4	
57	TRAVEL_FLAGS	Bit String (Unsigned8)	D	R	Std	
58	TEMPERATURE	Integer16	D	R	Std	
59	TOP_PRESSURE (Port 2)	float	D	R	Std	
60	BOTTOM_PRESSURE (Port 1)	float	D	R	Std	
61	SUPPLY_PRESSURE	float	D	R	Std	
62	VOLTAGE_REFERENCE	float	D	R	Std	
63	HALL_SENSOR	float	D	R	Std	
64	DAC_CHECK	float	D	R	Std	
65	MOD_CURRENT	float	D	R	Std	
66	IL_CHK	Integer16	D	R	Std	
67	INTERNAL_FLAGS	Bit String (Unsigned8)	D	R	Std	
68	PRESS_FLAGS	Bit String (Unsigned8)	D	R	Std	
69	PRESS_UNITS	Unsigned8	N	R/W	Info-1	psi
70	TEMP_UNITS	Unsigned8	N	R/W	Info-1	Deg F
71	ELECTRONICS_SN	Visible String	N	R/W*	Info-1	
72	SOFTWARE_VER	Unsigned16	N	R	Info-1	
73	FAIL_MODE	Unsigned8	S	R/W*	Info-1	Hold last position
Manufacturer Specific Parameters - Owned by Logix Control Processor – Added for Phase 2						
74	AD_RAW_FB	Integer16	D	R	Diag	
75	ERROR	float	D	R	Diag	
76	PGAIN	float	D	R	Diag	
77	INTEGRAL_SUM	float	N	R	Std	
78	ALPHA_FILT	float	N	R/W*	Diag	0.5
79	PRESS_WINDOW	float	S	R/W*	Info-2	0.01
80	PRESS_HYST	float	S	R/W*	Info-2	0.02
81	PRESS_GAIN	float	S	R/W*	Info-2	0.03
82	TP_ZERO	Integer16	N	R/W*	Diag	2
83	TP_SPAN	Integer16	N	R/W*	Diag	1175
84	TP_FULL_SCALE	Integer16	N	R/W*	Diag	1173
85	BP_ZERO	Integer16	N	R/W*	Diag	1175
86	BP_SPAN	Integer16	N	R/W*	Diag	1175
87	BP_FULL_SCALE	Integer16	N	R/W*	Diag	1173
88	SP_ZERO	Integer16	N	R/W*	Diag	2
89	SP_SPAN	Integer16	N	R/W*	Diag	1175
90	SP_FULL_SCALE	Integer16	N	R/W*	Diag	1173
91	FB_ZERO	Integer16	N	R/W*	Diag	

Table 8.5 Transducer Block Parameters (4 of 5)

Index	Fieldbus Parameter Name	Fieldbus Datatype	Storage	Read/ Write	Access Type	Notes, Default Values
92	FB_SPAN	Integer16	N	R/W*	Diag	
93	FB_SCOUNT	Integer16	N	R/W*	Diag	
94	HALL_NULL	Unsigned16	N	R/W*	Diag	150
95	HALL_DOWN	Unsigned16	N	R/W*	Diag	250
96	HALL_UP	Unsigned16	N	R/W*	Diag	50
97	POSALERT_HIGH	float	S	R/W	Info-2	110
98	POSALERT_LOW	float	S	R/W	Info-2	-10
99	POSDEV_DEADBAND	float	S	R/W	Info-2	2
100	POSDEV_TIME	float	S	R/W	Info-2	60
101	SIG_START	float	N	R/W*	Info-3	0
102	SIG_STOP	float	N	R/W*	Info-3	100
103	RAMP_RATE	float	N	R/W*	Info-3	200
104	STEP_TIME	float	N	R/W*	Info-3	10
105	SIG_FLAGS	Unsigned8	N	R/W*	Info-3	0.1
106	SAMPLE_TIME	float	N	R/W*	Info-3	
107	SIG_COUNTER	Unsigned16	D	R	Info-3	
108	INTAD_RAW1	Unsigned16	D	R	Diag	
109	INTAD_RAWTP	Unsigned16	D	R	Diag	
110	INTAD_RAWBP	Unsigned16	D	R	Diag	
111	INTAD_RAWSP	Unsigned16	D	R	Diag	
112	INTAD_RAW3	Unsigned16	D	R	Diag	
113	INTAD_RAW4	Unsigned16	D	R	Diag	
114	INTAD_RAW5	Unsigned16	D	R	Diag	
115	INTAD_RAW6	Unsigned16	D	R	Diag	
116	INTAD_RAW8	Unsigned16	D	R	Diag	
117	TEST_MODE	Unsigned8	D	R/W*	Info-2	Uninitialized
118	VALVE_SIZE	Unsigned8	N	R/W	Info-2	Uninitialized
119	VALVE_CLASS	Unsigned8	N	R/W	Info-2	Uninitialized
120	VALVE_ENDCON	Unsigned8	N	R/W	Info-2	Uninitialized
121	VALVE_BODYMAT	Unsigned8	N	R/W	Info-2	Uninitialized
122	VALVE_TRIMMAT	Unsigned8	N	R/W	Info-2	Uninitialized
123	VALVE_TRIMCHAR	Unsigned8	N	R/W	Info-2	Uninitialized
124	VALVE_TRIMTYPE	Unsigned8	N	R/W	Info-2	Uninitialized
125	VALVE_TRIMNO	Unsigned8	N	R/W	Info-2	Uninitialized
126	VALVE_PACKTYPE	Unsigned8	N	R/W	Info-2	Uninitialized
127	STROKE_OPENTIM	float	N	R/W	Info-2	Uninitialized
128	STROKE_CLOSEDTIM	float	N	R/W	Info-2	Uninitialized
129	STROKE_TSTPSI	float	N	R/W	Info-2	60
130	STEM_DIAM	float	N	R/W	Info-2	Uninitialized

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Table 8.5 Transducer Block Parameters (5 of 5)

Index	Fieldbus Parameter Name	Fieldbus Datatype	Storage	Read/ Write	Access Type	Notes, Default Values
131	LEAK_CLASS	Unsigned8	N	R/W	Info-2	Uninitialized
132	INLET_PRESS	float	N	R/W	Info-2	Uninitialized
133	OUTLET_PRESS	float	N	R/W	Info-2	Uninitialized
134	VALVE_FLAGS	Unsigned8	N	R/W	Info-2	Uninitialized
135	RATED_TRAV	float	N	R/W	Info-2	Uninitialized
136	ACT_TYPE	Unsigned8	N	R/W	Info-2	Uninitialized
137	ACT_SIZE	Unsigned8	N	R/W	Info-2	Uninitialized
138	SPRING_TYPE	Unsigned8	N	R/W	Info-2	Uninitialized
139	SPOOL_ID	Unsigned8	N	R/W	Info-2	Uninitialized
140	PO_DATE[8]	Visible String	N	R/W	Info-2	MMDDYYYY
141	INSTALL_DATE[8]	Visible String	N	R/W	Info-2	MMDDYYYY
142	LOAD_EE_DEFAULTS	Unsigned8	D	R/W*	Info-2	
143	ENG_RELEASE_NUM	Unsigned16	N	R	Info-1	
144	MISC_FLAGS	Unsigned8	N	R/W*	Info-2	
Manufacturer Specific Parameters - Owned by Fieldbus Processor						
145	SIG_INDEX	Unsigned16	D	R/W*		Honeywell
146	SIG_DATA[4]	float[4]	D	R		Honeywell
147	MFG_PHONE[18]	Visible String	N	R/W		Honeywell
148	PUR_ORDER_NUM[18]	Visible String	N	R/W		Honeywell
149	GENERIC_PARM_NUM	DS-66	D	R/W		Honeywell sts: type val: Logix Var Num
150	GENERIC_PARM_VAL	Unsigned32	D	R/W		Honeywell
151	SPI_TEST_RCV	Unsigned8[]	D	R		Honeywell
152	SPI_TEST_TX	Unsigned8[]	D	R		Honeywell
153	BLOCK_TEST	Unsigned8[]	D	R/W		Honeywell

* Must be out-of-service to write.

Access Type

NOTE: How the Fieldbus board accesses the respective Control board variable.

- Std — Standard Parameters. These values are constantly updated from the Control Board, except during the 'Signature' capture.
- Info — Device Information Parameters. These values are read only at start-up or when any of them are changed. The number -n is used to group parameters into manageable sizes.
- Diag — Advanced Diagnostic Parameters. These values are active only when the parameter ‘Enable diagnostic Variable Access’ is set in TEST_MODE.

Transducer Block Diagram Figure 8.2 is a block diagram showing the basic components of the transducer block.

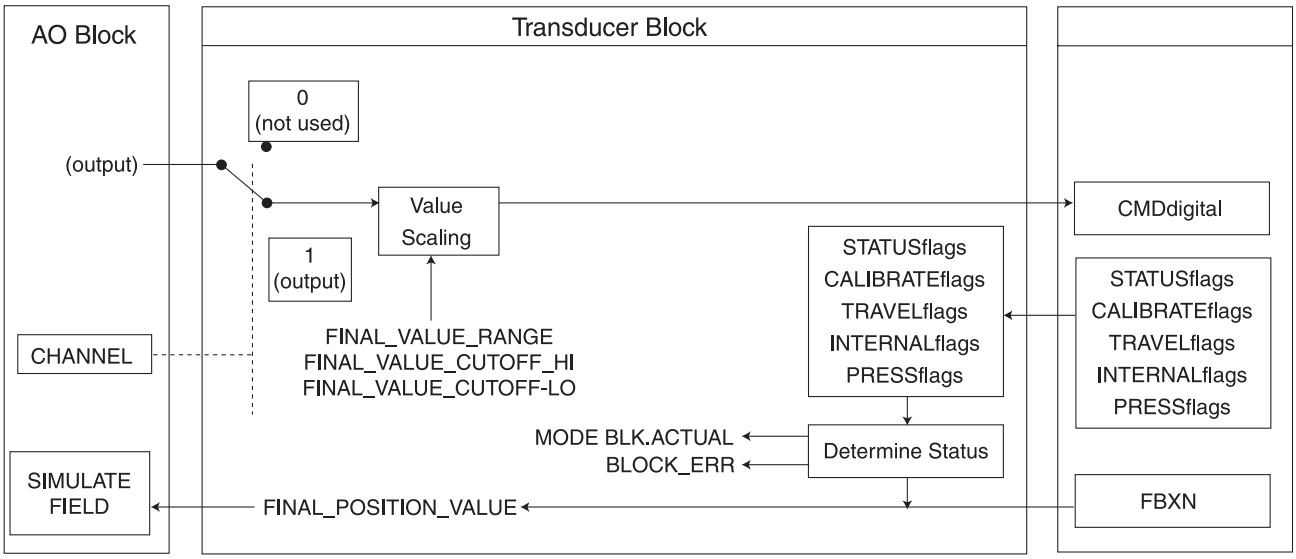

Figure 8.2 Transducer Block Diagram

Transducer Block Valtek Product-defined Parameters Table 8.6 describes the Logix parameters included in the transducer block

Table 8.6 Transducer Block Parameter Descriptions (1 of 2)

Parameter	Default Value	Function
MODE_BLK:TARGET	OOS	Determines the mode of the function block
FINAL_VALUE	No default	Command going to positioner before characterization, soft stops or MPC.
FINAL_VALUE_CUTOFF_HI	110%	This will saturate the actuator in an open position if FINAL_VALUE becomes greater than the cutoff value.
FINAL_VALUE_CUTOFF_LO	1%	This will saturate the actuator in a close position if FINAL_VALUE becomes less than the cutoff value. This is the same has the Minimum Position Cutoff feature of the Logix 1200 digital positioner. The new terminology matches FF terminology
FINAL_POSITION_VALUE	Dynamic	Actual stem position in percent of stroke
FINAL_VALUE_RANGE	110% to -10%	The high and low range limit values, the engineering units code and the number of digits to the right of the decimal point to be used to display the final value.
DAC_PERCENT	Dynamic	DAC output in percent

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Table 8.6 Transducer Block Parameter Descriptions (2 of 2)

Parameter	Default Value	Function
CONTROL_FLAGS	Advanced Model	Used to tell positioner type of actuator and characterization to use
GAIN_UPPER	2	Maximum proportional gain used.
GAIN_LOWER	1	Minimum proportional gain used.
GAIN_MULT	0.05	Adjust the rate of change between GAIN_UPPER and GAIN_LOWER. Same as in the 1200.
IGAIN	10	Integral gain.
IL_OFFSET	30-70%	DAC value to hold spool in a null position
SOFTSTOP_HIGH	110%	Software upper stroke limit
SOFTSTOP_LOW	-10%	Software lower stroke limit
PRESS_UNITS	Psi	Units pressure sensors reading are expressed in.
TEMP_UNITS	Deg F	Units temperature is expressed in.

Parameter Definitions

The following list summarizes some of the key parameters within the Logix 1400 digital positioner. For definitions of parameters not listed, use the help window in the NI Configurator. The Logix positioner automatically stores changed parameters in non-volatile memory when a change is made.

FINAL_VALUE: This is the set-point or command received by the 1400.

FINAL_VALUE_CUTOFF_HI: If FINAL_VALUE is greater than FINAL_VALUE_CUTOFF_HI, the positioner will saturate the actuator in an open position. A 1 percent hysteresis is added, so FINAL_VALUE must be more than 1 percent smaller than FINAL_VALUE_CUTOFF_HI, before the positioner will allow the valve to start closing. This feature is disabled in SOFTSTOP_HIGH is less than or equal to 100 percent.

FINAL_VALUE_CUTOFF_LO: If FINAL_VALUE is less than FINAL_VALUE_CUTOFF_LO the positioner will saturate the actuator in a closed position. There is a 1 percent hysteresis added, so FINAL_VALUE must be more than 1 percent of FINAL_VALUE_CUTOFF_LO, before the positioner will allow the valve to start opening. This feature is disabled in SOFTSTOP_LOW is less than or equal to 0 percent.

FINAL_POSITION_VALUE: This is the valve's stem position, as sensed by the positioner. This value is always reported in percent of stroke.

CONTROL_FLAGS: Eight options are provided under CONTROL_FLAGS. Each option has a significant effect on how the positioner controls the valve. The CONTROL_FLAGS should be configured correctly.

- **Quick Opening Curve:** The Logix 1400 digital positioner comes with a default quick opening curve. If this response is desired, check the Quick Opening Curve and Custom Characterization Active boxes
- **Equal Percent Curve:** The Logix 1400 digital positioner comes with a default equal percent curve. If this response is desired, check the Equal Percent Curve and Custom Characterization Active boxes.

- **Actuator Type:** Check this box only when the positioner is mounted on a single acting type actuator. This will disable the second pressure sensor.
- **Positioner Model:** This parameter is automatically set at power-up. It tells the positioner if it is an advanced (pressure sensors) model or standard (no pressure sensors). If the user wishes to over-ride the Auto Model Detect feature consult the factory.
- **Actuator Style:** Check this box only if the positioner is mounted on a rotary type actuator.
- **Custom Characterization Active:** Check this box the FINAL_VALUE parameter is to be characterized. If the Quick Opening or Equal Percent box is also checked the positioner will use a factory defined curve. If only Custom Characterization Active is checked, a user-defined curve will be used. Note that when this box is checked the curve can not be changed. If the user wishes to use a different curve, or edit the custom curve, this box must be unchecked.
- **Fail Position:** Currently this has no function.
- **Air Action:** Check this box only if the actuator is tubed to be Air-to-Close (ATC). After configuring CONTROL_FLAGS, click the write button to apply the values.

GAIN_UPPER: The Logix 1400 digital positioner uses a special gain algorithm. The proportional gain increases with a decrease in error. This allows for maximum resolution and speed. GAIN_UPPER is the upper limit to proportional gain.

GAIN_LOWER: The Logix 1400 digital positioner uses a special gain algorithm. The proportional gain increases with a decrease in error. This allows for maximum resolution and speed. GAIN_LOWER is the lower limit to proportional gain.

GAIN_MULT: The Logix 1400 digital positioner uses a special gain algorithm. The proportional gain increases with a decrease in error. This allows for maximum resolution and speed. GAIN_MULT adjust the transition rate between GAIN_UPPER and GAIN_LOWER.

IGAIN: In addition to proportional gain the Logix uses integral as well. This in the integral gain setting. Typically this is set to 10.

IL_OFFSET: This parameter tells the positioner where the spool valves null position is. This value is set during a stroke calibration procedure and typically requires no further adjustments.

CMD_USED: This is the set point or command to which the positioner is controlling. After FINAL_VALUE is acted on by Characterization, Softstops, and FINAL_VALUE_CUTOFF, CMD_USED reports the modified or used command value.

CALIBRATE: This parameter initiates calibration. Three types of calibration are available: Stroke, Pressure Sensors (advanced models only) and Stroke Time Test. Stroke time test will measure the stoke speed of the actuator from a 1 percent to 99 percent position, and from 99 percent to 1 percent. To learn more about calibration refer to the Calibration section of this document.

PRESS_CAL: Before doing a pressure sensor calibration, enter the supply pressure being used in units expressed by PRESS_UNITS.

SOFTSTOP_HIGH: Software imposed stroke limit. The positioner will not allow the valve to open beyond the value shown in this parameter.

SOFTSTOP_LOW: Software imposed stroke limit. The positioner will not allow the valve to close beyond the value shown in this parameter.

CYCLE_COUNTER: This parameter counts the number of cycles that have occurred.

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CYCLE_DEADBAND: In order for a cycle to be counted it must be greater than the value in this field.

CYCLE_LIMIT: If CYCLE_COUNTER exceeds this value, the yellow LED will start to blink and a warning generated in TRAVEL_FLAGS.

TRAVEL_ENG: Total distance the valve has traveled.

TRAVEL_DEADBAND: Amount in percent of stroke the valve must move in order for the movement to be added to TRAVEL_ENG.

TRAVEL_ALERT: If TRAVEL_ENG exceeds this value the yellow LED will start to blink and a warning generated in TRAVEL_FLAGS.

STROKE_ENG: Stoke length of valve. This value is used to calculate TRAVEL_ENG.

TRAVEL_UNITS: Units of measure used to calculate TRAVEL_ENG.

PRESS_UNITS: Units of measure that pressure sensor readings are expressed in.

TEMP_UNITS: Units of measure that temperature is expressed in.

FAIL_MODE: Should a loss of communications occur between the fieldbus card and positioner card this parameter sets the fail mode of the valve. Nothing selected will cause the positioner to hold the last known command should a loss of communications occurs.

Signatures: See Section 10.13, *Initiating a Valve Signature,* on page 129 for more details on using the signature acquisition functions of the Logix 1400 digital positioner.

Custom Characterization: See Section 10.11, *Stroke Characterization,* on page 126 for more details on using the custom characterization features of the Logix 1400 digital positioner.

8.6 Analog Output Function Block

AO Block Description

The Analog Output function block serves as the external interface for the transducer function block. The value of SP is used to produce the OUT value which is then sent to the transducer block to specify the valve position. PV reflects the actual valve position reported by the transducer block.

The AO function block operates on the output value from a control block [such as PID] and performs the following primary functions (most can be user configured):

- Set-point source selection limiting
- Units conversion
- Fault state action
- Position read back
- Alarming
- Mode control
- Output calculation

The database contains the standard AO block database, as defined in the FF FBAP specifications. Flowserve product extensions are specified in the Logix 1400 digital positioner parameter dictionary and are described below.

The interface to the AO block contains the following:

- Execute function block
- Database read access
- Alarm acknowledgment
- Database write access

AO Block Connections

CAS_IN is the only linkable input parameter and is used with a PID function block for direct cascade connection. RCAS_IN is a contained input parameter used for remote cascade connection.

OUT and BKCAL_OUT are linkable output parameters. RCAS_OUT is a contained output parameter for remote cascade connection.

The OUT parameter of the AO block is used to set the FINAL_POSITION_VALUE in the transducer block, as modified by the FINAL_VALUE_RANGE.

Fail-safe Handling

The fail-safe parameters determine the response of an output block to the following conditions. FSTATE_TIME is the number of seconds without communication or with Initiate Fail Safe at the CAS_IN status, required to put this block into the fail safe state. The FAULT_STATE parameter of the resource block may also put this block into the fail safe state. The Failsafe Type I/O option determines whether the action is simply to hold, or to move to FSTATE_VAL.

The Target to Manual if IFS I/O option may be used to latch the fail safe state when IFS appears in the CAS_IN status. This will cause a fail-safe block alarm. After the cause of the IFS status is removed, the target mode may be returned manually to CAS mode when it is safe to do so.

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AO Block Parameter List Table 8.7 lists the block parameters and default values for the AO function block.

Table 8.7 AO Function Block Parameter List (1 of 2)

Block Index	Name	Store Type	Data Type (Units)	Valid Range	Write Restrictions	Default Value
1	ST_REV	s	Unsigned16		Read Only	0
2	TAG_DESC	s	Octet String			All spaces
3	STRATEGY	s	Unsigned16			0
4	ALERT_KEY	s	Unsigned8			0
5	MODE_BLK	Mix	MODE_BLK			Target = OOS Permitted = OS + MAN + AUTO + CAS + RCAS Normal = AUTO
6	BLOCK_ERR	d	Bit String		Read Only	
7	PV	D	ANALOG (PV)		Read Only	
8	SP	N	ANALOG (PV)	PV_SCALE, +/- 10%	Target mode must be AUTO, CAS or RCAS, not permitted during cascade initialization, tracking cannot be operative.	
9	OUT	N	ANALOG (XD)	XD_SCALE, +/- 10%	Target mode must be Man or OOS	
10	SIMULATE	D	SIM_FLOAT			Enable = OFF
11	PV_SCALE	S	SCALING		Actual mode must be Man or OOS	0 – 100
12	XD_SCALE	S	SCALING		Actual mode must be Man or OOS	0 – 100
13	GRANT_DENY	D	ACCESS_ PERM_T			
14	IO_OPTS	S	Bit String		Target mode must be OOS	0
15	STATUS_OPTS	S	Bit String		Target mode must be OOS	0
16	READBACK	D	ANALOG (XD)		Read Only	
17	CAS_IN	N	ANALOG (PV)			
18	SP_RATE_DN	S	Float (PV / seconds)	Positive		+INF
19	SP_RATE_UP	S	Float (PV / seconds)	Positive		+INF
20	SP_HI_LIM	S	Float (PV)	PV_SCALE, +/- 10%		100
21	SP_LO_LIM	S	Float (PV)	PV_SCALE, +/- 10%		0
22	CHANNEL	S	Unsigned16	Must be 1	Target mode must be OOS	0

Table 8.7 AO Function Block Parameter List (2 of 2)

Block Index	Name	Store Type	Data Type (Units)	Valid Range	Write Restrictions	Default Value
23	FSTATE_TIME	S	Float (seconds)	Positive		0
24	FSTATE_VAL	S	Float (PV)	PV_SCALE, +/- 10%		0
25	BKCAL_OUT	D	ANALOG (PV)		Read Only	
26	RCAS_IN	N	ANALOG (PV)			
27	SHED_OPT	S	Unsigned8	1 to 8		0
28	RCAS_OUT	D	ANALOG (PV)		Read Only	
29	UPDATE_EVT	D	EVENT			
30	BLOCK_ALM	D	ALARM_ DISCRETE			
31	WSP*	D	ANALOG (PV)			
32	BLOCK_TEST*	D	Array of Unsigned8		Read Only	All zeros

* Extension parameter

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AO Block Diagram Figure 8.3 is a block diagram showing the key components of the AO function block.

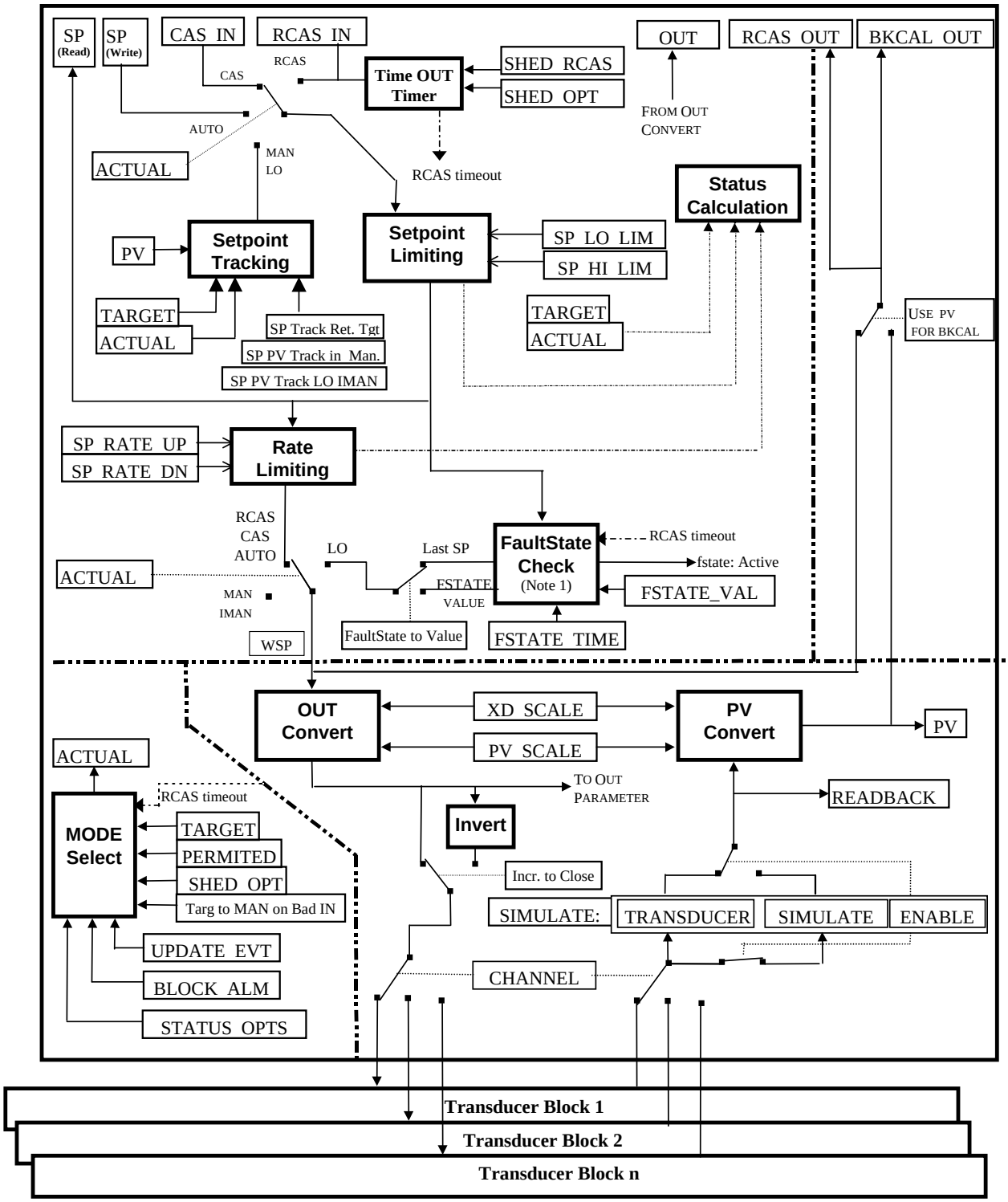

Figure 8.3 AO Function Block Diagram

Clearing Block Configuration Errors

Block configuration errors prevent the block from leaving OOS mode. The parameter BLOCK_ERR will show whether a block configuration error is present. Table 8.8 is a list of parameters that can cause the status of CONFIGURATION ERROR to be set in the AO BLOCK_ERR parameter.

NOTE: CONFIGURATION ERROR can only be cleared if the function block is being executed. One way of determining block execution is by performing a series two or three reads of the BLOCK_TEST parameter and confirming that the first byte of the parameter is incrementing. This will work if the execute rate is fast relative to the speed of reading BLOCK_TEST. A very slowly executing block may not *appear* to execute because block parameters are updated only when the block executes.

Parameter	Initial Value	Valid Range	Corrective action
CHANNEL	0	1	*Initial value is a configuration error.* Set value in valid range.
SHED_OPT	0	1-8 (see Shed Options in the FF specs.)	*Initial value is a configuration error.* Set value in valid range.
SP_HI_LIM SP_LO_LIM	100 0	PV_SCALE +/- 10%	Verify that SP_HI_LIM > SP_LO_LIM.

Mode-restricted Write Operations

Table 8.7 lists the AO block parameters which may be write restricted based upon the block's mode. Listed in the table are the TARGET **and/or** ACTUAL modes required for the write to be accepted. Other limitations listed in the last column must also be met.

SIMULATE, READBACK and PV Determination

In the AO Function Block, these three parameters provide the values and status of the actuator position, where SIMULATE (or optionally OUT) generates the READBACK parameter and READBACK is then re-scaled to produce the PV.

The following sub-sections describe each of these parameters.

SIMULATE Parameter: SIMULATE is the interface parameter between the AO and the Transducer Function Blocks. Each time the AO block executes, SIMULATE.TRANSDUCER is updated with the FINAL_POSITION_VALUE from the transducer block.

When the SIMULATE.ENABLE is FALSE, SIMULATE.TRANSDUCER is copied into SIMULATE.SIMULATE. When SIMULATE.ENABLE is TRUE, SIMULATE.SIMULATE is not updated with SIMULATE.TRANSDUCER and the user may write a value and status to SIMULATE.SIMULATE.

NOTE: SIMULATE.ENABLE can only be set TRUE when the Simulate Jumper is in the Y position when the device is powered up or a processor restart is issued.

READBACK Parameter: The value and status of READBACK will come from either the OUT parameter or SIMULATE.SIMULATE, determined by the state of the OUT_READBACK feature in the Resource Block. READBACK is in XD units.

When RS.FEATURE.OUT_READBACK is set TRUE, SIMULATE.SIMULATE is used for READBACK. When FEATURE.OUT_READBACK is FALSE, OUT will be used for READBACK.

NOTE: The default value for RS.FEATURE.OUT_READBACK is FALSE. With the Logix 1400, this feature should always be set TRUE to allow the transducer block position value to be the source of READBACK.

PV Parameter: The PV value is simply the READBACK value, re-scaled from XD units to PV units. PV status is copied directly from READBACK status.

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8.7 PID Function Block

PID Block Description

The PID function block provides a choice of selecting either a standard PID control equation (Ideal) or a robust PID defined in Table 8.9 on page 59.

PID Block Parameter List

Table 8.8 lists the block parameters and default values for the PID function block.

Table 8.8 PID Control Function Block Parameters (1 of 4)

Index	Name	Store Type	Data Type (Units)	Valid Range	Write Restrictions	Default Value
1	ST_REV*	s	Unsigned16		Read Only	0
2	TAG_DESC	s	Octet String			All blanks
3	STRATEGY	s	Unsigned16			0
4	ALERT_KEY	s	Unsigned8			0
5	MODE_BLK	Mix	MODE_BLK		Actual is Read Only	Target = OOS Permitted = OS + MAN + AUTO+ CAS + RCAS + ROUT Normal = AUTO
6	BLOCK_ERR	d	Bit String		Read Only	
7	PV	D	ANALOG (PV)		Read Only	
8	SP	N	ANALOG (PV)	PV_SCALE, +/- 10%	Target mode must be AUTO, CAS or RCAS, not in cascade initialization, and tracking cannot be operative.	
9	OUT	N	ANALOG (OUT)	OUT_SCALE, +/- 10%	Target mode must be Man or OOS	
10	PV_SCALE	S	SCALING (PV)		Actual mode must be Man or OOS	0 – 100
11	XD_SCALE	S	SCALING (XD)		Actual mode must be Man or OOS	0 – 100
12	GRANT_DENY	D	ACCESS_ PERM_T			
13	CONTROL_OPTS	S	Bit String		Target mode must be OOS	0
14	STATUS_OPTS	S	Bit String		Target mode must be OOS	0
15	IN	N	ANALOG (PV)			
16	PV_FTIME	S	Float (seconds)	0 – 200.0	Actual mode = Man or OOS	0
17	BYPASS	S	Unsigned8	1 – Off 2 – On	To turn BYPASS On, Control Opts. Bypass Enable must be TRUE	0 (Un-initialized)

Table 8.8 PID Control Function Block Parameters (2 of 4)

Index	Name	Store Type	Data Type (Units)	Valid Range	Write Restrictions	Default Value
18	CAS_IN	N	ANALOG (PV)			
19	SP_RATE_DN	S	Float (PV / second)	Positive		+INF
20	SP_RATE_UP	S	Float (PV / second)	Positive		+INF
21	SP_HI_LIM	S	Float (PV)	PV_SCALE, +/- 10%		100
22	SP_LO_LIM	S	Float (PV)	PV_SCALE, +/- 10%		0
23	GAIN	S	Float	0.0 or 0.004 – 250.0		0
24	RESET	S	Float (seconds)	$(2 \bullet T_S) - 7500$		+INF
25	BAL_TIME	S	Float (seconds)			0
26	RATE	S	Float (seconds)	$(32 \bullet T_S) - 7500$		0
27	BKCAL_IN	N	ANALOG (PV)			
28	OUT_HI_LIM	S	Float (OUT)	OUT_SCALE, +/- 10%	Must be greater or equal to OUT_LO_LIM except in OOS	100
29	OUT_LO_LIM	S	Float (OUT)	OUT _SCALE, +/- 10%	Must be less or equal to OUT_HI_LIM except in OOS	0
30	BKCAL_HYS	S	Float (percent)	0.0 – 50.0		0.5
31	BKCAL_OUT	D	ANALOG (PV)		Read Only	
32	RCAS_IN	N	ANALOG (PV)			
33	ROUT_IN	D	ANALOG (OUT)			0
34	SHED_OPT	S	Unsigned8	1 – 8		0 (Un-initialized)
35	RCAS_OUT	D	ANALOG (PV)		Read Only	
36	ROUT_OUT	D	ANALOG (OUT)		Read Only	

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Table 8.8 PID Control Function Block Parameters (3 of 4)

Index	Name	Store Type	Data Type (Units)	Valid Range	Write Restrictions	Default Value
37	TRK_SCALE	S	ANALOG (TRK)		Actual mode must be Man or OOS	
38	TRK_IN_D	N	DISCRETE			
39	TRK_VAL	N	ANALOG (TRK)			
40	FF_VAL	N	ANALOG (FF)			
41	FF_SCALE	S	SCALING (FF)			0 - 100
42	FF_GAIN	S	Float (none)		Actual mode must be Man or OOS	0
43	UPDATE_EVT	D	EVENT		Read Only	
44	BLOCK_ALM	D	ALARM_ DISCRETE			
45	ALARM_SUM	D	ALARM_ SUMMARY			
46	ACK_OPTION	S	Bit String			0
47	ALARM_HYS	S	Float (percent)	0.0 – 50.0		0.5
48	HI_HI_PRI	S	Unsigned8	0 - 15		0
49	HI_HI_LIM	S	Float (PV)	+INF, PVS-CALE	Must be less than HI_LIM except in OOS	+INF
50	HI_PRI	S	Unsigned8	0 – 15		0
51	HI_LIM	S	Float (PV)	+INF, PVS-CALE	LO_LIM - HI_HI_LIM except in OOS	+INF
52	LO_PRI	S	Unsigned8	0 – 15		0
53	LO_LIM	S	Float (PV)	-INF, PVS-CALE	LO_LO_LIM - HI_LIM except in OOS	-INF
54	LO_LO_PRI	S	Unsigned8	0 – 15		0
55	LO_LO_LIM	S	Float (PV)	-INF, PVS-CALE	Must be greater than LO_LIM except in OOS	-INF
56	DV_HI_PRI	S	Unsigned8	0 – 15		0
57	DV_HI_LIM	S	Float (PV)	+INF, PVS-CALE		+INF
58	DV_LO_PRI	S	Unsigned8	0 – 15		0
59	DV_LO_LIM	S	Float (PV)	-INF, PVS-CALE		-INF
60	HI_HI_ALM	D	ALARM_ FLOAT			
61	HI_ALM	D	ALARM_ FLOAT			
62	LO_ALM	D	ALARM_ FLOAT			

Table 8.8 PID Control Function Block Parameters (4 of 4)

Index	Name	Store Type	Data Type (Units)	Valid Range	Write Restrictions	Default Value
63	LO_LO_ALM	D	ALARM_ FLOAT			
64	DV_HI_ALM	D	ALARM_ FLOAT			
65	DV_LO_ALM	D	ALARM_ FLOAT			
66†	PID_FORM	S	Unsigned8	1 = IDEAL 2 = ROBUST	Actual mode must be Man or OOS	1
67†	ALGO_TYPE	S	Unsigned8	1 = Type A 2 = Type B 3 = Type C	Actual mode must be Man or OOS	1
68†	OUT_LAG	S	Float (seconds)	$(2 \bullet T_S)$ – 7500.0	PID_FORM must = 2 (ROBUST)	
69†	GAIN_NLIN	S	Float (none)		Actual mode must be Man or OOS	0
70†	GAIN_COMP	D	Float (none)		Read Only	
71†	ERROR_ABS	D	Float (PV)		Read Only	
72†	WSP	D	ANALOG (PV)		Read Only	
73†	BLOCK_TEST	D	Array of Unsigned8		Read Only	All zeros

* Special NVM parameter which is update on parameter write.

† Extension parameter.

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Honeywell-defined PID Parameters

The Honeywell-defined parameters provide a robust PID algorithm. A description of these parameters is in Table 8.9.

Table 8.9 Honeywell PID Parameters

Parameter Name	Description/Parameter Contents
PID_FORM	Configuration parameter specifies the IDEAL or ROBUST PID equation to be used: IDEAL PID (default). Non-Interactive form of a three mode control equation that provides Proportional, Integral and Derivative (PID) control action. Linear and non-linear gain parameters are available. ROBUST PID. The same as Ideal PID. Additionally, the equation supports a user-configured lag filter applied to calculated output value. (See OUT_LAG parameter.) Linear and non-linear gain parameters are available.
ALGO_TYPE	Configuration parameter specifies algorithm type which can be A, B, or C: Type A equation where Proportional, Integral and Derivative act on ERROR. Type B equation where Proportional and Integral act on ERROR and Derivative acts on PV. Type C equation where Integral acts on ERROR and Proportional and Derivative act on PV.
OUT_LAG	Time constant of single exponential LAG filter applied to the OUT parameter (primary output). Units (in seconds). For ideal PID equation the lag filter is fixed at 1/16 and cannot be configured.
GAIN_NLIN	Dimensionless gain factor. When the gain factor is multiplied by absolute value of the error and added to the linear GAIN, the result is a gain response which is proportional to the deviation. Default is zero, resulting in no response due to non-linear gain action.
GAIN_COMP	The composite gain quantity including both linear and non-linear gain parameters. (Read-only parameter.)
ERROR_ABS	Absolute value of the difference between PV and working set-point. (Read-only parameter.)
WSP	Working set-point. This is the set-point value after absolute and rate limits have been applied. Deviation alarms are computed on this value. (Read-only parameter.)
BLOCK_TEST	An internal Honeywell test parameter.

PID Block Diagram

Figure 8.4 is a block diagram showing the key components of the PID control function block.

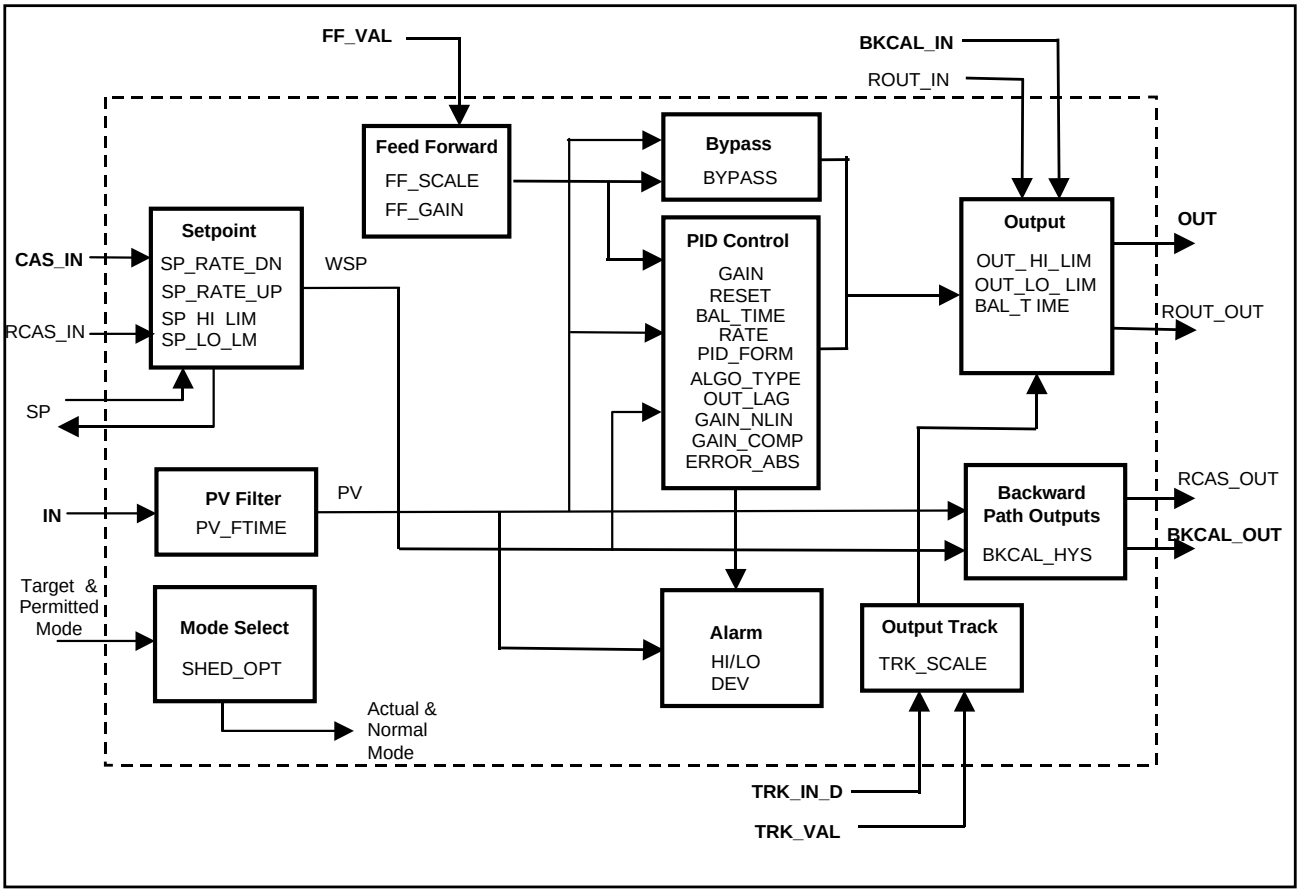

Figure 8.4 PID Control Block

PID Block Description

PID control function block is an algorithm that produces an output signal in response to the measured variable and the set-point. The PID function block allows the user to choose either a standard PID control equation (Ideal) or a robust PID equation defined by Honeywell. This selection is defined in the PID_FORM parameter.

The output has three terms: Proportional, Integral and Derivative. The output is adjusted by tuning constants. Three tuning constants are contained in the ideal PID equation. The robust PID uses four tuning constants.

1. GAIN is the tuning constant of the Proportional term.
2. RESET is the tuning constant of the Integral term.
3. RATE is the tuning constant of the Derivative term. RATE is usually modified by a lag, which is set at some fixed ratio higher than the rate time to create a rate gain. No lag occurs with the rate in this implementation.
4. OUT_LAG is the fourth tuning constant used in the robust PID, it adds roll off to the output response. The action is similar to PID with rate gain.

PID Ideal and PID Robust

The ideal equation is a parallel or non-interacting implementation of PID control using three tuning constants. It automatically fixes OUT_LAG to 16 times the RATE time con-

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stant. This produces response characteristics equivalent to the algorithms used in TPS products.

The robust equation is the same parallel implementation of ideal PID control but allows the engineer to set the OUT_LAG and effectively change the rate gain.

ALGO_TYPE is a configuration parameter that contains one of three selected algorithm types, A, B, or C.

Where:

- A - RATE, GAIN and RESET all act on the error between set point and measured variable.
- B - RATE acts on the measured variable only, GAIN and RESET use the error.
- C - RATE and GAIN act on the measured variable only, and RESET uses the error.

PID Tuning Parameters

Table 8.10 lists the valid ranges for the tuning parameters for the PID block. Note that OUT_LAG parameter is cannot be configured when ideal PID is selected (PID_FORM = 1) and can be configured when robust PID is selected (PID_FORM = 2).

The values given for these tuning parameters are valid under the following conditions:

- The values assume that the minimum configured PID function block execution period (T_S) is 0.125 seconds.
- Algorithm type setting (i.e. A, B, or C) has no effect on the validation of these tuning parameters.
- The PID function block will reject all values outside these ranges.

Table 8.10 PID Tuning Parameter Values

Parameter	Initial Value	Minimum Value	Maximum Value	Comment
PV_FTIME	0	0	200	Units: seconds.
GAIN	0	.004	250	
GAIN_NLIN	0	.004	250	
RATE (sec.)	0	32 • T_S	7500	The value of ZERO is permitted to turn off rate action.
RESET (sec.)	+INF	2 • T_S	7500	The value of +INF is permitted to turn off reset action. (Some versions of NI-FBUS Configurator program cannot set +/- INF)
OUT_LAG				
Ideal PID	N/A	N/A	N/A	Fixed for ideal PID form - cannot be configured.
Robust PID	0	2 • T_S	7500	Zero permitted, which implies no output lag.
BAL_TIME	0	N/A	N/A	Not used in Honeywell Implementation.

Mode-restricted Writes to PID Parameters

Writing to certain PID block parameters are restricted by the block's TARGET and/or ACTUAL mode. The MODE_BLK.TARGET or MODE_BLK.ACTUAL parameter must equal one of the modes in the 'Write Restrictions Column' in Table 8.8 before the user can write values to the parameters listed.

8.8 Block Parameter Summary

Table Description

Table 8.11 provides a description of the block parameter attributes that are listed in the Block Parameter Summary, Table 8.14 to Table 8.17.

Table 8.11 Table Description for Block Parameter Summary (1 of 2)

Column Title Attribute	**Meaning**
Obj Type Object Type	Object type for the parameter value: **S** - Simple Variable **R** - Record **A** - Array of simple variables
Data Type/Structure	Data Type or Structure for the parameter value: **1.** Data Types consist of a simple variable or array and are: **Unsigned8, Unsigned16 Unsigned32** - An unsigned variable of 8, 16 or 32 bits. **Float -** Floating point variable. **2.** Data Structures consist of a record which may be: **Value and Status - float** - Value and status of a floating point parameter. **Scaling** - Static data used to scale floating point values for display purposes.
Use/Model Use and Model Reference (The letter for use is separated by a slash from the model name.)	The manner in which the parameter will participate in inter-device communications. Use is defined as: **I** - Function block Input. The input may be connected to a function block output or used as a constant. **O** - Function block Output. An output may be referenced by other function block inputs. **C** - Parameter value Contained in the block, available for interface (operation, diagnostic) and/or configuration. Model is: The name of the parameter. In this case, the attribute indicates that it is a contained parameter and may not be referenced by link objects for use as an input to function blocks.
Store	Indicates the type of memory where the parameter is stored: **S** - Static. Writing to the parameter changes the static revision counter ST_REV **N** - Non-volatile. Parameter must be retained during a power cycle. It is not under the static update code. **D** - Dynamic. The value is calculated by the block, or read from another block.
Size	The number of octets.

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Table 8.11 Table Description for Block Parameter Summary (2 of 2)

Column Title Attribute	**Meaning**
Valid Range	Range of valid values the parameter is restricted to for use in the function block. For bit strings: 0 (zero) is always valid as the state of a bit and is the inverse of the described value. For enumeration: 0 (zero) means that the value is invalid. This is required for initialization of an un-configured block. Plus or minus infinity (+INF or -INF) may be included in the valid range to indicate that it is permissible to use them to turn off a limit comparison, such as an alarm limit.
Initial Value	The value inserted when the block is created. All limits are set to plus or minus infinity (+INF or -INF), which is the same as no limit. All dynamic values are initialized to zero as a result of a clear memory instruction.
Perm. Permission	Defines the setting of the GRANT_DENY parameter that allows write access to the parameter, for interface devices that obey this parameter.
Mode	Indicates the lowest priority target mode required to allow a change to the parameter. The actual mode must match the target mode, so that the block is not in another mode than that chosen by the operator. Scaling changes are protected by mode, because the block may be using scaling to calculate its output.
Other	DD handling for: Positive Ordered and Read only. **NOTE:** For parameters that are inputs: If it is linked, it is read-only. If it is not linked, it can be written to.
Range Check	Flag to check that the value is within the valid range given in the table.

Parameter Summary

A summary of the Fieldbus Foundation-defined parameters can be found in FF-890 and FF-891 *Foundation Specification Function Block Application Process Parts 1 and* 2.

Table 8.12 Resource Block Parameter Summary

Parameter Mnemonic	Obj. Type	Data Type	Use/Model	Store	Size	Valid Range	Initial Value	Units	Perm.	Mode	Other	Range Check
DL_CMD1	S	Unsigned8	C/Contained	D	1					OOS	written sequentially	
DL_CMD2	S	Unsigned8	C/Contained	D	1					OOS	written sequentially	
DL_APPSTATE	S	Unsigned16	C/Contained	S	2						Read-only	
DL_SIZE	S	Unsigned32	C/Contained	S	4						Read-only	
DL_CHECKSUM	S	Unsigned16	C/Contained	S	2						Read-only	
REVISION_ARRAY	A[3]	Unsigned16	C/Contained	S	6						Read-only	
BLOCK_TEST	A [8]	Unsigned8	C/Contained	D	8							
ERROR_DETAIL	A [3]	Unsigned16	C/Contained	D	6		0,0,0				Read-only	

Table 8.13 Transducer Block Parameter Summary (1 of 6)

Parameter Mnemonic	Obj Type	Data Type	Use/Model	Store	Size	Valid Range	Initial Value	Units	Perm	Mode	Other	Range Check
TRANSDUCER_ DIRECTORY	S	Unsigned16	C/Contained	N	2						Read-only	
TRANSDUCER_TYPE	S	Unsigned16	C/Contained	N	2	106	106				Read-only	Fixed Value
XD_ERROR	S	Unsigned8	C/Contained	D	1						Read-only, Not used	
COLLECTION_ DIRECTORY	S	Unsigned32	C/Contained	N	4						Read-only	
FINAL_VALUE	R	DS-65	C/Contained	N	5							
FINAL_VALUE_ RANGE	R	DS-68	C/Contained	S	11		-5 to 105					Units only
FINAL_VALUE_ CUTOFF_HI	S	Float	C/Contained	S	4		110					
FINAL_VALUE_ CUTOFF_LO	S	Float	C/Contained	S	4		1					
FINAL_POSITION_ VALUE	R	DS-65	C/Contained	N	5						Read-only	
SERVO_GAIN	S	Float	C/Contained	S	4		0.0				Not Used	
SERVO_RESET	S	Float	C/Contained	S	4		0.0				Not Used	
SERVO_RATE	S	Float	C/Contained	S	4		0.0				Not Used	
ACT_FAIL_ACTION	S	Unsigned8	C/Contained	S	1						See FAIL_MODE	
ACT_MAN_ID	S	Unsigned32	C/Contained	N	4	enum.	Note 5					

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Table 8.13 Transducer Block Parameter Summary (2 of 6)

Parameter Mnemonic	Obj Type	Data Type	Use/Model	Store	Size	Valid Range	Initial Value	Units	Perm	Mode	Other	Range Check
ACT_MODEL_NUM	S	Visible String	C/Contained	N	32		NULL					
ACT_SN	S	Visible String	C/Contained	N	32		NULL					
VALVE_MAN_ID	S	Unsigned32	C/Contained	N	4	enum.	Note 5					
VALVE_MODEL_NO	S	Visible String	C/Contained	N	32		NULL					
VALVE_SN	S	Visible String	C/Contained	N	32		FLWSERV					
VALVE_TYPE	S	Unsigned8	C/Contained	N	1	enum.	Note 5					
XD_CAL_LOC	S	Visible String	C/Contained	N	32		NULL					
XD_CAL_DATE	S	Visible String	C/Contained	N	8		NULL					
XD_CAL_WHO	S	Visible String	C/Contained	N	32		NULL					
			C/Contained									
Manufacturer Specific Parameters												
DAC_PERCENT	S	float	C/Contained	D	4	0-100					Read-only Note 1	
CONTROL_FLAGS	S	Bit String	C/Contained	S	1	enum.	Note 4			O/S	Note 3	
GAIN_UPPER	S	float	C/Contained	S	4		2			O/S	Note 3	
GAIN_LOWER	S	float	C/Contained	S	4		1			O/S	Note 3	
GAIN_MULT	S	float	C/Contained	S	4		0.05			O/S	Note 3	
IGAIN	S	Integer16	C/Contained	N	2		10			O/S	Note 3	
IL_OFFSET	S	float	C/Contained	N	4		55			O/S	Note 3	
STATUS_FLAGS	S	Bit String	C/Contained	N	1	enum.	0				Read-only	
CMD_USED	S	float	C/Contained	D	4	-10 to 110					Read-only	
CALIBRATE	S	Unsigned8	C/Contained	D	1	enum.	Normal Operation			O/S	Note 3	
DAC_VALUE	S	Unsigned16	C/Contained	D	2	0 - 4095				O/S	Note 2, 3	
PRESS_CAL	S	float	C/Contained	N	4		60				Note 3	
CALIBRATE_FLAGS	S	Bit String	C/Contained	D	1	enum.					Read-only	
SOFTSTOP_HIGH	S	float	C/Contained	S	4	-10 to 110	110			O/S	Note 3	
SOFTSTOP_LOW	S	float	C/Contained	S	4	-10 to 110	-10			O/S	Note 3	
CYCLE_COUNTER	S	Unsigned32	C/Contained	N	4	$0 – 4.29x10^9$	0				Note 3	
CYCLE_DEADBAND	S	float	C/Contained	S	4	.10 – 100	20				Note 3	
CYCLE_LIMIT	S	Unsigned32	C/Contained	S	4	$0 – 4.29x10^9$	4294967294				Note 3	
TRAVEL_ENG	S	float	C/Contained	N	4	$0 – 4.29x10^9$	0				Note 3	
TRAVEL_DEADBAND	S	float	C/Contained	S	4	.10 – 100	20				Note 3	
TRAVEL_ALERT	S	float	C/Contained	S	4	$0 – 4.29x10^9$	2e+006				Note 3	

Table 8.13 Transducer Block Parameter Summary (3 of 6)

Parameter Mnemonic	Obj Type	Data Type	Use/Model	Store	Size	Valid Range	Initial Value	Units	Perm	Mode	Other	Range Check
STROKE_ENG	S	float	C/Contained	N	4	$0 – 4.29x10^9$	1				Note 3	
TRAVEL_UNITS	S	Unsigned8	C/Contained	S	1	$0 – 4.29x10^9$	inches				Note 3	
CURVEX	A[21]	float	C/Contained	S	84	-10 to 110%				O/S	Note 3	
CURVEY	A[21]	float	C/Contained	S	84	-10 to 110%				O/S	Note 3	
TRAVEL_FLAGS	S	Bit String	C/Contained	D	1	enum.	0				Read-only	
TEMPERATURE	S	Integer16	C/Contained	D	2						Read-only	
TOP_PRESSURE	S	float	C/Contained	D	4						Read-only	
BOTTOM_PRESSURE	S	float	C/Contained	D	4						Read-only	
SUPPLY_PRESSURE	S	float	C/Contained	D	4						Read-only	
VOLTAGE_REFERENCE	S	float	C/Contained	D	4						Read-only	
HALL_SENSOR	S	float	C/Contained	D	4						Read-only	
DAC_CHECK	S	float	C/Contained	D	4						Read-only	
MOD_CURRENT	S	float	C/Contained	D	4						Read-only	
IL_CHK	S	Integer16	C/Contained	D	2						Read-only	
INTERNAL_FLAGS	S	Bit String	C/Contained	D	1	enum.	0				Read-only	
PRESS_FLAGS	S	Bit String	C/Contained	D	1	enum.	0				Read-only	
PRESS_UNITS	S	Unsigned8	C/Contained	N	1	enum.	psi				Note 3	
TEMP_UNITS	S	Unsigned8	C/Contained	N	1	enum.	Deg. F				Note 3	
ELECTRONICS_SN	A[8]	Visible String	C/Contained	N	8						Read-only	
SOFTWARE_VER	S	Integer16	C/Contained	N	2						Read-only	
FAIL_MODE	S	Unsigned8	C/Contained	S	1	enum	Hold last position			O/S	Note 3	
AD_RAW_FB	S	Integer16	C/Contained	D	2	0 – 4095					Read-only Note 1	
ERROR	S	float	C/Contained	D	4						Read-only Note 1	
PGAIN	S	float	C/Contained	D	4						Read-only Note 1	
INTEGRAL_SUM	S	float	C/Contained	N	4	-20 to 20 %					Read-only	
ALPHA_FILT	S	float	C/Contained	N	4		0.5			O/S	Note 1, 3	
PRESS_WINDOW	S	float	C/Contained	S	4	0 – 100 %	0.01			O/S	Note 3	
PRESS_HYST	S	float	C/Contained	S	4	0 – 100 %	0.02			O/S	Note 3	
PRESS_GAIN	S	float	C/Contained	S	2	0 – 100	0.03			O/S	Note 3	
TP_ZERO	S	Integer16	C/Contained	N	2	1 – 4094	2			O/S	Note 1,3	
TP_SPAN	S	Integer16	C/Contained	N	2	1 – 4094	1175			O/S	Note 1,3	
TP_FULL_SCALE	S	Integer16	C/Contained	N	2	1 – 4093	1173			O/S	Note 1,3	
BP_ZERO	S	Integer16	C/Contained	N	2	1 – 4094	2			O/S	Note 1,3	

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Table 8.13 Transducer Block Parameter Summary (4 of 6)

Parameter Mnemonic	Obj Type	Data Type	Use/Model	Store	Size	Valid Range	Initial Value	Units	Perm	Mode	Other	Range Check
BP_SPAN	S	Integer16	C/Contained	N	2	1 – 4094	1175			O/S	Note 1,3	
BP_FULL_SCALE	S	Integer16	C/Contained	N	2	1 – 4093	1173			O/S	Note 1,3	
SP_ZERO	S	Integer16	C/Contained	N	2	1 – 4094	2			O/S	Note 1,3	
SP_SPAN	S	Integer16	C/Contained	N	2	1 – 4094	1175			O/S	Note 1,3	
SP_FULL_SCALE	S	Integer16	C/Contained	N	2	1 – 4093	1173			O/S	Note 1,3	
FB_ZERO	S	Integer16	C/Contained	N	2	1 – 4094				O/S	Note 1,3	
FB_SPAN	S	Integer16	C/Contained	N	2	1 – 4094				O/S	Note 1,3	
FB_SCOUNT	S	Integer16	C/Contained	N	2	1 – 4093				O/S	Note 1,3	
HALL_NULL	S	Unsigned16	C/Contained	N	2	0 – 1024	150			O/S	Note 1,3	
HALL_DOWN	S	Unsigned16	C/Contained	N	2	0 – 1024	250			O/S	Note 1,3	
HALL_UP	S	Unsigned16	C/Contained	N	2	0 – 1024	50			O/S	Note 1,3	
POSALERT_HIGH	S	float	C/Contained	S	4	-10 to 110%	110				Note 3	
POSALERT_LOW	S	float	C/Contained	S	4	-10 to 110%	-10				Note 3	
POSDEV_DEADBAND	S	float	C/Contained	S	4	100 to .1%	2				Note 3	
POSDEV_TIME	S	Float	C/Contained	S	4		60				Note 3	
SIG_START	S	float	C/Contained	N	4	110 to –10%	0			O/S	Note 3	
SIG_STOP	S	float	C/Contained	N	2	110 to –10%	100			O/S	Note 3	
RAMP_RATE	S	float	C/Contained	N	4	>1	200			O/S	Note 3	
STEP_TIME	S	float	C/Contained	N	4	0 -650 s	10			O/S	Note 3	
SIG_FLAGS	S	Unsigned8	C/Contained	N	1					O/S	Note 3	
SAMPLE_TIME	S	float	C/Contained	N	4	.1 – 2.55 s	0.1			O/S	Note 3	
SIG_COUNTER	S	Unsigned16	C/Contained	D	2						Read-only	
INTAD_RAW1	S	Unsigned16	C/Contained	D	2	0 – 4095					Read-only Note 1	
INTAD_RAWTP	S	Unsigned16	C/Contained	D	2	0 – 4095					Read-only Note 1	
INTAD_RAWBP	S	Unsigned16	C/Contained	D	2	0 – 4095					Read-only Note 1	
INTAD_RAWSP	S	Unsigned16	C/Contained	D	2	0 – 4095					Read-only Note 1	
INTAD_RAW3	S	Unsigned16	C/Contained	D	2	0 – 4095					Read-only Note 1	
INTAD_RAW4	S	Unsigned16	C/Contained	D	2	0 – 4095					Read-only Note 1	
INTAD_RAW5	S	Unsigned16	C/Contained	D	2	0 – 4095					Read-only Note 1	
INTAD_RAW6	S	Unsigned16	C/Contained	D	2	0 – 4095					Read-only Note 1	
INTAD_RAW8	S	Unsigned16	C/Contained	D	2	0 – 4095					Read-only Note 1	
TEST_MODE	S	Unsigned8	C/Contained	D	1	Enum	Note 5			O/S	Note 3	
VALVE_SIZE	S	Unsigned8	C/Contained	N	1	Enum	Note 5				Note 3	

Table 8.13 Transducer Block Parameter Summary (5 of 6)

Parameter Mnemonic	Obj Type	Data Type	Use/Model	Store	Size	Valid Range	Initial Value	Units	Perm	Mode	Other	Range Check
VALVE_CLASS	S	Unsigned8	C/Contained	N	1	Enum	Note 5				Note 3	
VALVE_ENDCON	S	Unsigned8	C/Contained	N	1	Enum	Note 5				Note 3	
VALVE_BODYMAT	S	Unsigned8	C/Contained	N	1	Enum	Note 5				Note 3	
VALVE_TRIMMAT	S	Unsigned8	C/Contained	N	1	Enum	Note 5				Note 3	
VALVE_TRIMCHAR	S	Unsigned8	C/Contained	N	1	Enum	Note 5				Note 3	
VALVE_TRIMTYPE	S	Unsigned8	C/Contained	N	1	Enum	Note 5				Note 3	
VALVE_TRIMNO	S	Unsigned8	C/Contained	N	1	Enum	Note 5				Note 3	
VALVE_PACKTYPE	S	Unsigned8	C/Contained	N	1	Enum	Note 5				Note 3	
STROKE_OPENTIM	S	float	C/Contained	N	4		0				Note 3	
STROKE_CLOSEDTIM	S	float	C/Contained	N	4		0				Note 3	
STROKE_TSTPSI	S	float	C/Contained	N	4		0				Note 3	
STEM_DIAM	S	float	C/Contained	N	4		1.0				Note 3	
LEAK_CLASS	S	Unsigned8	C/Contained	N	1	Enum	Note 5				Note 3	
INLET_PRESS	S	float	C/Contained	N	4		0				Note 3	
OUTLET_PRESS	S	float	C/Contained	N	4		0				Note 3	
VALVE_FLAGS	S	Unsigned8	C/Contained	N	1	Enum	Note 5				Note 3	
RATED_TRAV	S	float	C/Contained	N	4		0				Note 3	
ACT_TYPE	S	Unsigned8	C/Contained	N	1	Enum	Note 5				Note 3	
ACT_SIZE	S	Unsigned8	C/Contained	N	1	Enum	Note 5				Note 3	
SPRING_TYPE	S	Unsigned8	C/Contained	N	1	Enum	Note 5				Note 3	
SPOOL_ID	S	Unsigned8	C/Contained	N	1	Enum	Note 5				Note 3	
PO_DATE[8]	A[8]	Visible String	C/Contained	N	8		Mmddyyyy				Note 3	
INSTALL_DATE[8]	A[8]	Visible String	C/Contained	N	8		Mmddyyyy				Note 3	
LOAD_EE_DEFAULTS	S	Unsigned8	C/Contained	D	1	Enum	Normal Operation			O/S	Note 3	
ENG_RELEASE_NUM	S	Unsigned16	C/Contained	N	2						Read-only	
MISC_FLAGS	S	Unsigned8	C/Contained	N	1	Enum	0			O/S	Note 3	
SIG_INDEX	S	Unsigned16	C/Contained	D	2		0			O/S	Note 3	
SIG_DATA	A[4]	Float	C/Contained	D	4						Read-only	
MFG_PHONE	A[18]	Visible String	C/Contained	N	18		8014898611					
PUR_ODER_NUM	A[18]	Visible String	C/Contained	N	18		NULL					
GENERIC_PARM_NUM	R	DS-66	C/Contained	D	2		Signed int					
GENERIC_PARM_VAL	S	Unsigned32	C/Contained	D	4		0					
SPI_TEST_RCV	A [16]	Unsigned8	C/Contained	D	16						Read-only	

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Table 8.13 Transducer Block Parameter Summary (6 of 6)

Parameter Mnemonic	Obj Type	Data Type	Use/Model	Store	Size	Valid Range	Initial Value	Units	Perm	Mode	Other	Range Check
SPI_TEST_TX	A [16]	Unsigned8	C/Contained	D	16						Read-only	
BLOCK_TEST	A [8]	Unsigned8	C/Contained	D	8							

Notes for Transducer Blocks, all releases:

1. Diagnostic Parameter. This parameter is only accessible if TEST_MODE bit 7 ‘Enable Diagnostic Scan List’ is set.
2. DAC_VALUE can only be written if TEST_MODE bit 7 AND bit 0 ‘Write to DAC_Value’ are set.
3. Parameter may not be written if SIG_FLAGS bit 0 ‘BEGIN_SIG’ is set. (The Signature Analysis program is running.)
4. 0x00 if the positioner is a standard model. Advanced Model if the positioner is an advanced type (pressure sensors). This is determined from hardware settings at start-up
5. This enumeration shows ‘Uninitialized’ when value is 0.

Table 8.14 Analog Output Function Block Parameter Summary

Parameter Mnemonic	Obj Type	Data Type	Use/Model	Store	Size	Valid Range	Initial Value	Units	Perm.	Mode	Other	Range Check
OUT	F	Value and Status - float	C/Contained	N	4		0					
BLOCK_TEST	A [8]	Unsigned8	C/Contained	D	8							
WSP	S	DS-65	C/Contained	D	5	PV_SCALE	0				Read-only	

Table 8.15 PID Function Block Parameter Summary

Parameter Mnemonic	Obj Type	Data Type	Use/Model	Store	Size	Valid Range	Initial Value	Units	Perm.	Mode	Other	Range Check
PID_FORM	S	Unsigned8	C/Contained	S	1	1: Ideal 2: Robust	1	enum		MAN		
ALGO_TYPE	S	Unsigned8	C/Contained	S	1	1: A, 2: B 3: C	0	enum		MAN		
OUT_LAG	S	Float	C/Contained	S	4		0	sec.	TUNE	MAN	Positive	
GAIN_NLIN	S	Float	C/Contained	S	4		0		TUNE	MAN		
GAIN_COMP	S	Float	C/Contained	D	4		0				Read-only	
ERROR_ABS	S	Float	C/Contained	D	4	PV Scale	0	PV			Read-only	
WSP	R	DS-65	C/Contained	D	5	PV Scale	0	PV			Read-only	
BLOCK_TEST	A [8]	Unsigned8	C/Contained	D	8							

8.9 Link Objects

Background

The function blocks configured to control a process are linked, or connected by objects within the devices. These links allow the user to transfer process and event data from one block to another. These links are defined through link objects.

Link Object Description

Link objects define Virtual Communication Relationships (VCRs), which are used to communicate between blocks. Link objects contain information needed to define communication links between function blocks and interface devices and other field devices. This information may be read by an interface device which will access information in field devices.

Example

For example, link objects may be used to link the output parameter of one function block to the input of another block, or a trend object, or alert object.

Logix 1400 Digital Positioner Link Objects

Link objects are used for alarms and events, function block linking and trending. In the Logix 1400 digital positioner links objects are available for:

- The PID block (6 input parameters)
- The PID and AO blocks (3 output parameters)
- Every alert object
- Every trend object

Table 8.16 lists the link objects defined in the Logix 1400 digital positioner

Table 8.16 Link Objects Defined for Logix 1400 Digital Positioner

Link Object for	Parameter or Number of Objects
Input parameters	PID function block: BKCAL_IN CAS_IN FF_VAL IN TRK_IN_D TRK_VAL
Output parameters	AO function block: OUT PID function block: BKCAL_OUT OUT
Alert objects	3
Trend objects	2
TOTAL	14 objects

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8.10 View Objects

Description

View objects support management and control of function blocks by providing user visibility of function block configuration and operation. View objects allow parameter data to be grouped and accessed (for viewing on an operator interface) by the user. This provides for information groups to be communicated efficiently. At least four view objects (View1, View2, View3 and View4.) are defined for each resource block, function block, and transducer block in a device.

Block parameters can be grouped and displayed depending on how the data is to be used. Four standard view objects (groups) are defined for accessing the following types of information:

1. View1 - used to display dynamic operation data
2. View2 - used to display static operation data
3. View3 - used to display all dynamic data
4. View4 - used to display other static data.

Logix 1400 Digital Positioner View Objects

In the Logix 1400 digital positioner, four view objects have been defined for each of the four blocks - for a total of 16 view objects. Some parameters are accessible in all four views, while others are available in one view.

Table 8.17 Resource Block View List (1 of 2)

Index	Name	View1	View2	View3	View4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	RS_STATE	1		1	
8	TEST_RW				
9	DD_RESOURCE				
10	MANUFAC_ID				4
11	DEV_TYPE				2
12	DEV_REV				1
13	DD_REV				1
14	GRANT_DENY		2		
15	HARD_TYPES				2
16	RESTART				
17	FEATURES				2
18	FEATURE_SEL		2		
19	CYCLE_TYPE				2
20	CYCLE_SEL		2		
21	MIN_CYCLE_T				4
22	MEMORY_SIZE				2
23	NV_CYCLE_T		4		

Table 8.17 Resource Block View List (2 of 2)

Index	Name	View1	View2	View3	View4
24	FREE_SPACE		4		
25	FREE_TIME	4		4	
26	SHED_RCAS		4		
27	SHED_ROUT		4		
28	FAULT_STATE	1		1	
29	SET_FSTATE				
30	CLR_FSTATE				
31	MAX_NOTIFY				1
32	LIM_NOTIFY		1		
33	CONFIRM_TIME		4		
34	WRITE_LOCK		1		
35	UPDATE_EVT				
36	BLOCK_ALM				
37	ALARM_SUM	8		8	
38	ACK_OPTION				2
39	WRITE_PRI				1
40	WRITE_ALM				
Manufacturer Specific Parameters					
41	DL_CMD1				
42	DL_CMD2				
43	DL_APPSTATE			2	
44	DL_SIZE			4	
45	DL_CHECKSUM			2	
46	REVISION_ARRAY				6
47	BLOCK_TEST			8	
48	ERROR_DETAIL			6	
	Total	22	30	44	35

Table 8.18 Transducer View Block List (1 of 5)

Index	Name	View1	View2	View3	View4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	UPDATE_EVT				
8	BLOCK_ALM				
9	TRANSDUCER_DIRECTORY				

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Table 8.18 Transducer View Block List (2 of 5)

Index	Name	View1	View2	View3	View4
10	TRANSDUCER_TYPE	2	2	2	2
11	XD_ERROR	1		1	
12	COLLECTION_DIRECTORY				
13	FINAL_VALUE	5		5	
14	FINAL_VALUE_RANGE		11		
15	FINAL_VALUE_CUTOFF_HI				4
16	FINAL_VALUE_CUTOFF_LO				4
17	FINAL_POSITION_VALUE	5		5	
18	SERVO_GAIN				4
19	SERVO_RESET				4
20	SERVO_RATE				4
21	ACT_FAIL_ACTION				1
22	ACT_MAN_ID				1
23	ACT_MODEL_NUM				32
24	ACT_SN				32
25	VALVE_MAN_ID				
26	VALVE_MODEL_NUM				
27	VALVE_SN				
28	VALVE_TYPE				
29	XD_CAL_LOC				
30	XD_CAL_DATE				
31	XD_CAL_WHO				
Manufacturer Specific Parameters					
32	DAC_PERCENT				
33	CONTROL_FLAGS				
34	GAIN_UPPER				
35	GAIN_LOWER				
36	GAIN_MULT				
37	IGAIN				
38	IL_OFFSET				
39	STATUS_FLAGS				
40	CMD_USED				
41	CALIBRATE				
42	DAC_VALUE				
43	PRESS_CAL				
44	CALIBRATE_FLAGS				
45	SOFTSTOP_HIGH				
46	SOFTSTOP_LOW				
47	CYCLE_COUNTER				

Table 8.18 Transducer View Block List (3 of 5)

Index	Name	View1	View2	View3	View4
48	CYCLE_DEADBAND				
49	CYCLE_LIMIT				
50	TRAVEL_ENG				
51	TRAVEL_DEADBAND				
52	TRAVEL_ALERT				
53	STROKE_ENG				
54	TRAVEL_UNITS				
55	CURVEX				
56	CURVEY				
57	TRAVEL_FLAGS				
58	TEMPERATURE				
59	TOP_PRESSURE				
60	BOTTOM_PRESSURE				
61	SUPPLY_PRESSURE				
62	VOLTAGE_REFERENCE				
63	HALL_SENSOR				
64	DAC_CHECK				
65	MOD_CURRENT				
66	IL_CHK				
67	INTERNAL_FLAGS				
68	PRESS_FLAGS				
69	PRESS_UNITS				
70	TEMP_UNITS				
71	ELECTRONICS_SN				
72	SOFTWARE_VER				
73	FAIL_MODE				
74	AD_RAW_FB				
75	ERROR				
76	PGAIN				
77	INTEGRAL_SUM				
78	ALPHA_FILT				
79	PRESS_WINDOW				
80	PRESS_HYST				
81	PRESS_GAIN				
82	TP_ZERO				
83	TP_SPAN				
84	TP_FULL_SCALE				
85	BP_ZERO				
86	BP_SPAN				
87	BP_FULL_SCALE				

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Table 8.18 Transducer View Block List (4 of 5)

Index	Name	View1	View2	View3	View4
88	SP_ZERO				
89	SP_SPAN				
90	SP_FULL_SCALE				
91	FB_ZERO				
92	FB_SPAN				
93	FB_SCOUNT				
94	HALL_NULL				
95	HALL_DOWN				
96	HALL_UP				
97	POSALERT_HIGH				
98	POSALERT_LOW				
99	POSDEV_DEADBAND				
100	POSDEV_TIME				
101	SIG_START				
102	SIG_STOP				
103	RAMP_RATE				
104	STEP_TIME				
105	SIG_FLAGS				
106	SAMPLE_TIME				
107	SIG_COUNTER				
108	INTAD_RAW1				
109	INTAD_RAWTP				
110	INTAD_RAWBP				
111	INTAD_RAWSP				
112	INTAD_RAW3				
113	INTAD_RAW4				
114	INTAD_RAW5				
115	INTAD_RAW6				
116	INTAD_RAW8				
117	TEST_MODE				
118	VALVE_SIZE				
119	VALVE_CLASS				
120	VALVE_ENDCON				
121	VALVE_BODYMAT				
122	VALVE_TRIMMAT				
123	VALVE_TRIMCHAR				
124	VALVE_TRIMTYPE				
125	VALVE_TRIMNO				
126	VALVE_PACKTYPE				
127	STROKE_OPENTIM				

Table 8.18 Transducer View Block List (5 of 5)

Index	Name	View1	View2	View3	View4
128	STROKE_CLOSEDTIM				
129	STROKE_TSTPSI				
130	STEM_DIAM				
131	LEAK_CLASS				
132	INLET_PRESS				
133	OUTLET_PRESS				
134	VALVE_FLAGS				
135	RATED_TRAV				
136	ACT_TYPE				
137	ACT_SIZE				
138	SPRING_TYPE				
139	SPOOL_ID				
140	PO_DATE				
141	INSTALL_DATE				
142	LOAD_EE_DEFAULTS				
143	ENG_RELEASE_NUM				
144	MISC_FLAGS				
145	SIG_INDEX				
146	SIG_DATA				
147	MFG_PHONE				
148	PUR_ODER_NUM				
149	GENERIC_PARM_NUM				
150	GENERIC_PARM_VAL				
151	SPI_TEST_RCV				
152	SPI_TEST_TX				
153	BLOCK_TEST				
	Total	21	15	21	93

Table 8.19 AO Block View Table (1 of 2)

Index	Name	View1	View2	View3	View4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	PV	5		5	
8	SP	5		5	
9	OUT	5		5	
10	SIMULATE				

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Table 8.19 AO Block View Table (2 of 2)

Index	Name	View1	View2	View3	View4
11	PV_SCALE		11		
12	XD_SCALE		11		
13	GRANT_DENY		2		
14	IO_OPTS				2
15	STATUS_OPTS				2
16	READBACK	5		5	
17	CAS_IN	5		5	
18	SP_RATE_DN				4
19	SP_RATE_UP				4
20	SP_HI_LIM		4		
21	SP_LO_LIM		4		
22	CHANNEL				2
23	FSTATE_TIME				4
24	FSTATE_VAL				4
25	BKCAL_OUT			5	
26	RCAS_IN			5	
27	SHED_OPT				1
28	RCAS_OUT			5	
29	UPDATE_EVT				
30	BLOCK_ALM				
Manufacturer Specific Parameters					
31	WSP	5		5	
32	BLOCK_TEST			8	
	Total	38	34	61	28

Table 8.20 PID Block View Table (1 of 3)

Index	Name	View1	View2	View3	View4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	PV	5		5	
8	SP	5		5	
9	OUT	5		5	
10	PV_SCALE		11		
11	OUT_SCALE		11		
12	GRANT_DENY		2		

Table 8.20 PID Block View Table (2 of 3)

Index	Name	View1	View2	View3	View4
13	CONTROL_OPTS				2
14	STATUS_OPTS				2
15	IN			5	
16	PV_FTIME				4
17	BYPASS		1		
18	CAS_IN	5		5	
19	SP_RATE_DN				4
20	SP_RATE_UP				4
21	SP_HI_LIM		4		
22	SP_LO_LIM		4		
23	GAIN				4
24	RESET				4
25	BAL_TIME				4
26	RATE				4
27	BKCAL_IN			5	
28	OUT_HI_LIM		4		
29	OUT_LO_LIM		4		
30	BKCAL_HYS				4
31	BKCAL_OUT			5	
32	RCAS_IN			5	
33	ROUT_IN			5	
34	SHED_OPT				1
35	RCAS_OUT			5	
36	ROUT_OUT			5	
37	TRK_SCALE				11
38	TRK_IN_D	2		2	
39	TRK_VAL	5		5	
40	FF_VAL			5	
41	FF_SCALE				11
42	FF_GAIN				4
43	UPDATE_EVT				
44	BLOCK_ALM				
45	ALARM_SUM	8		8	
46	ACK_OPTION				2
47	ALARM_HYS				4
48	HI_HI_PRI				1
49	HI_HI_LIM				4
50	HI_PRI				1
51	HI_LIM				4
52	LO_PRI				1

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Table 8.20 PID Block View Table (3 of 3)

Index	Name	View1	View2	View3	View4
53	LO_LIM				4
54	LO_LO_PRI				1
55	LO_LO_LIM				4
56	DV_HI_PRI				1
57	DV_HI_LIM				4
58	DV_LO_PRI				1
59	DV_LO_LIM				4
60	HI_HI_ALM				
61	HI_ALM				
62	LO_ALM				
63	LO_LO_ALM				
64	DV_HI_ALM				
65	DV_LO_ALM				
Manufacturer Specific Parameters					
66	PID_FORM		1		
67	ALGO_TYPE		1		
68	OUT_LAG		4		
69	GAIN_NLIN		4		
70	GAIN_COMP	4		4	
71	ERROR_ABS	4		4	
72	WSP	5		5	
73	FUTURE1				
74	BLOCK_TEST			8	
	Total	56	53	104	104

8.11 Alert Objects

Description

Alert objects support the reporting of alarms and update events to operator interface devices and other field devices. Alert objects are used to communicate notification messages when alarms or events are detected. These objects are defined in the function block application.

Alert objects contain:

- The value of the data
- Block index (a number)
- Alert key (parameter)
- Time stamp
- Priority

Logix 1400 Digital Positioner Alert Objects

Three alert objects are defined in the Logix 1400 digital positioner for event and alarm reporting.

- 1 for events
- 1 for discrete alarms
- 1 for analog alarms

8.12 Alarm and Event Reporting

Fieldbus Alarms, Events and Alert Objects

Alarms are generated when a block leaves or returns from a particular state.

Events are instantaneous occurrences such as the change of a parameter.

Alarms and event messages are communicated to operator interfaces and other devices using alert objects.

Fieldbus Alarm Messages

Alarm messages are usually transparent to the user. A host system typically receives these messages and presents them to the user.

Acknowledgment of alarms by the operator may be necessary to satisfy operation requirements.

Event Messages

- Event messages contain a time stamp
- Events also must be confirmed; otherwise the block will continually report the event.
- Acknowledgment of events may be necessary to satisfy operation requirements

Internal Positioner Alarms

NOTE: These are standard fieldbus alarms.

The Logix 1400 digital positioner has several internal alarms which monitor electronics operation. An internal alarm causes the red LED to blink. Positioner alarms differ from alerts because the action of the positioner may be erratic during the alarm conditions. Alert warns operations that a predefined, user-configured condition has occurred that may require service in the near future. Alarms cause the red LED to blink, while alerts cause the yellow LED to blink.

Refer to the following parameters to view positioner alarms:

- STATUS_FLAGS
- CALIBRATE_FLAGS
- TRAVEL_FLAGS
- INTERNAL_FLAGS
- PRESS_FLAGS

12 bit A/D Reference Alarm: The Logix 1400 digital positioner utilizes a 12-bit Analog-to-Digital (A/D) converter to acquire stem position readings. If the precision reference used by the A/D drifts outside rated tolerances, the 12 bit A/D Reference Alarm will become active. A reference error will cause change in calibration and control readings. If a continuous 12 bit A/D reference alarm exists, the main PCB assembly must be replaced. Refer to the *Logix Series 1000 Digital Positioner* IOM for spare parts kit numbers.

1.23 V Reference Alarm: The 1.23 V reference is used by the inner-loop spool position control. If it drifts outside normal tolerances, the 1.23 V reference alarm will become active. If a continuous 1.23 V reference alarm exists, the main PCB assembly must be

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replaced. Refer to the *Logix Series 1000 Digital Positioner* IOM for spare parts kit numbers.

12-bit D/A Alarm: The Logix 1400 digital positioner utilizes a 12-bit Digital-to-Analog (D/A) converter to send a control signal from the micro controller to the inner-loop spool positioning circuit. The output of the D/A converter is independently measured to verify correct operation. A 12 bit D/A alarm indicates that the D/A may be malfunctioning. If a continuous 12 bit D/A alarm exists, the main PCB assembly must be replaced. Refer to the *Logix Series 1000 Digital Positioner* IOM for spare parts kit numbers.

Temperature Alarm: The main PCB assembly contains an ambient temperature sensor. If the ambient temperature readings goes outside the operating range, -40°F to +185°F (-40°C to +85°C), the temperature alarm will become active. The red LED will also blink. If this alarm is present and the ambient temperature reading is incorrect, the main PCB assembly must be replaced. Refer to the *Logix Series 1000 Digital Positioner* IOM for spare parts kit numbers.

Hall sensor Alarm: As described in *Theory of Operation* on page 3, the Logix 1400 digital positioner incorporates an inner-loop, spool positioning stage. A hall sensor is used for spool control. If the electronics senses a problem with the sensor, the hall sensor alarm will become active. Some common reasons for a hall sensor alarm are loose or missing cable connection to the collector board assembly or a broken wire. In the rare event that the actual hall sensor is defective, the driver module assembly must be replaced. Refer to the *Logix Series 1000 Digital Positioner* IOM for spare parts kit numbers.

Modulator current Alarm: The pressure modulator is an electro-pneumatic device which takes a current signal from the electronics control and generates a pressure which moves the spool. The Logix 1400 digital positioner is a FB-powered device, which must run on very low power. The pressure modulator current is monitored during operation. If the current draw exceeds 0.9 mA under normal control, the modulator current alarm will become active and the red LED will blink. Sometimes, the current level may be right at the threshold of 0.9 mA, causing the LED to alternate between red and green. Listed below are some reasons for a modulator current alarm. The magnitude of modulator coil current can be viewed from the configurator.

- Modulator minimum pressure too low (refer to IOM)
- Clogged or restricted orifice
- Bad/missing cable connection to collector board assembly
- Stuck or sticky spool
- Internal air leaks in tubing, orifice gasket or pressure modulator

EEPROM checksum Alarm: Configuration data is stored in EEPROM. When power is lost, configuration information is retrieved from EEPROM and operation resumes. A check is done by the micro-controller after a power-up to make sure data saved in EEPROM has not been corrupted. The checksum is a number that is calculated based on configuration data. It is also saved in EEPROM every time data is stored. If after a power-up, this number does not match the data in memory, an EEPROM checksum alarm is generated and the red LED will blink. If this occurs, try powering the Logix 1400 digital positioner **off** and then back **on**. If the error does not clear, try saving configuration data again using FB Configurator. If previous configuration has not been saved, must be **reset** and reconfigure. If these steps still do not clear the error, the main PCB assembly must be replaced. Refer to the *Logix Series 1000 Digital Positioner* IOM for spare parts kit numbers.

Pressure Alarms

Pressure alarms are only available on models with advanced diagnostics (Logix 141X digital positioner). Advanced diagnostic models add top, bottom and supply pressure sensors. These sensor readings and alarms are only accessible from the communicator when the configuration has been set to Advanced.

Loss of Pressure: The loss of pressure alarm becomes active when the supply pressure is near the minimum positioner operating pressure of 30 psig. If the LEDs alternate between red and green, the supply pressure may be at the limit threshold. This alarm is meant to alert the user to low supply pressure as well as complete loss of pressure.

Top Sensor, Bottom Sensor, Supply Sensor: Each sensor is checked during actuator calibration. If a calibration reading appears to be out of range, the appropriate alarm will become active. The pressure sensors are located on the collector board assembly.

Internal Positioner Alerts

MPC: (FINAL_VALUE_CUTOFF_HI, FINAL_VALUE_CUTOFF_LO) The MPC or tight shutoff feature of the Logix 1400 digital positioner allows the user to control the level at which the command signal causes full actuator saturation in the closed (or open) position. This feature can be used to guarantee actuator saturation in the closed (or open) position or prevent throttling around the seat at small command signal levels. To enable, use configuration to apply the desired MPC threshold. *Note: The positioner automatically adds a 1 percent hysteresis value to the MPC setting to prevent jumping in and out of saturation when the command is close to the MPC setting.*

Question: I set the MPC at 5 percent. How will the positioner operate?

Answer: Assume that the present command signal is at 50 percent. If the command signal is decreased, the positioner will follow the command until it reaches 5 percent. At 5 percent, the spool will be driven in order to provide full actuator saturation. The positioner will maintain full saturation below 5 percent command signal. Now, as the command increases, the positioner will remain saturated until the command reaches 6 percent (remember the 1 percent hysteresis value added by the positioner). At this point, the stem position will follow the command signal.

Question: I have MPC set to 3 percent but the valve will not go below 10 percent?

Answer: Is a lower soft limit enabled? The lower soft limit must be less than or equal to 0 percent in order for the MPC to become active. If soft stops are active (SOFTSTOP_LOW ≥0, SOFTSTOP_HIGH≤100) FINAL_VALUE_HI or _LO is disabled.

Position Alerts

Position alerts notify the user that the valve has traveled past a configured limit. The default settings are –10 percent and 110 percent which are outside normal travel and, therefore, disabled. Position alerts only notify the user that a limit has been exceeded and do not limit stem movement. Position alerts will cause a yellow LED to blink.

Soft Limits

Unlike position alerts, soft limits (SOFTSTOP_LOW, SOFTSTOP_HIGH) prevent the stem position from going below or above the configured limits. If the command signal is trying to drive the position past one of the limits, the yellow LED will blink, but the stem position will remain at the set limit.

Travel Accumulator

The travel accumulator is equivalent to a car odometer and sums the total valve movement. Using the user-defined stroke length and travel dead band, the Logix 1400 digital positioner keeps a running total of valve movement. When the positioner first powers up, high and low dead band limits are calculated around the present position. When the stem position exceeds the travel dead band, the movement from the center of the dead band region to the new position is calculated and added to the travel accumulator. From this new position, dead band high and low limits are again calculated.

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Example: The Logix 1400 digital positioner has a default dead band configuration of 20 percent and the valve has a 4- inch linear stroke. When the valve first powers up, the command signal is 50 percent. The unit will calculate a high-travel threshold of 70 percent (50 percent present position plus 20 percent dead band) and a low-travel threshold of 30 percent (50 percent present position minus 20 percent dead band). As long as the stem position remains greater than 30 percent and less than 70 percent, no additions are made to the travel accumulator. Now, assume the stem position moves to 80 percent, which is outside the present dead band. The Logix 1400 digital positioner calculates the stem movement and adds this number to the travel accumulator.

80 percent (present position) – 50 percent (previous)= 30 percent movement x 4-inch stroke= 1.2 inches

So, 1.2 inches is added to the travel accumulator. New dead band thresholds of 100 percent (80 percent present position plus 20 percent dead band) and 60 percent (80 percent present position minus 20 percent dead band) are calculated. This process continues as the stem position moves throughout its stroke range.

Cycle Counter

The cycle counter is another means of monitoring valve travel. Unlike the travel accumulator, the stem position must do two things to count as a cycle: exceed the cycle counter dead band and change direction. A cycle counter limit can also be written into the positioner. If this limit is exceeded, the yellow LED will blink.

Position Deviation

If the stem position differs from the control command by a certain amount for a given length of time, the yellow LED will blink to signify excess deviation. The trip point and settling times are set in the transducer block.

8.13 Trend Objects

Description

Trend objects support the management and control of function blocks by providing access to history information. Trend objects provide for short-term history data to be collected and stored within a resource. The collected data may be input and output parameters, and status information from selected function blocks. Trend objects are available anytime for reading.

A user will not typically view trend objects directly. A host system may receive the data and build displays using the history data.

Logix 1400 Digital Positioner Trend Objects

The Logix 1400 digital positioner has one defined trend object.

8.14 Domain Objects

Description

Domain objects support download services which are used to download firmware to a device. Standard generic download services (defined by Fieldbus Foundation) are used in the domain object of the Logix 1400 digital positioner.

8.15 Device Description

Device Descriptions and ODs

A Device Description (DD) provides a clear and structured text description of a field device. The descriptions found in a DD supplement the object dictionary definitions of device applications. So an OD description used in conjunction with the DD will provide a complete detailed description of the device operation. (See the FF Fieldbus Specifications for more details about the usage of DDs and ODs.)

DD Diskette

The DD for the Logix 1400 digital positioner is contained on the diskette in the back of this manual. Refer to the fieldbus configurator documentation for details on the installation of the DD into the configurator.

Device Description Contents

A typical DD contains information about the device parameters and operation, such as:

- Attributes, like coding, name, engineering unit, write protection, how-to-display, etc.
- The menu structure for listing parameters, including names of menus and sub-menus.
- The relationship of one parameter to others
- Information about help text and help procedures
- Maintenance, calibration and other necessary operation information.

Standard and Device-specific DD

Standard DD descriptions for function blocks and transducer blocks are maintained by the Fieldbus Foundation. These descriptions can be used as part of a field device DD by manufacturers to describe the standard features of their devices. Device-specific descriptions are developed by manufacturers to describe custom features which are unique to that particular device.

These two types of DDs (the standard and device-specific) can then be combined to provide a complete DD for the field device.

8.16 Object Dictionary

Object Dictionary Description

AP objects are described in the Object Dictionary (OD) with each entry describing an individual AP object and its message data. The message data may consist of a number of characteristics defined for that particular object. The OD allows the FBAP of a device to be visible to the fieldbus communications system. Refer to the Fieldbus documentation for more information about OD.

Logix 1400 Digital Positioner Block Parameter Index

Table 8.21 lists the index numbers for all block parameters defined in the FBAP for Logix 1400 digital positioner.

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Table 8.21 Block Parameter Index Table (1 of 2)

Index	Parameter
257	BLOCK
258	ST_REV
259	TAG_DESC
260	STRATEGY
261	ALERT_KEY
262	MODE_BLK
263	BLOCK_ERR
264	PV
265	SP
266	OUT
267	SIMULATE
268	PV_SCALE
269	XD_SCALE
270	GRANT_DENY
271	IO_OPTS
272	STATUS_OPTS
273	READBACK
274	CAS_IN
275	SP_RATE_DN
276	SP_RATE_UP
277	SP_HI_LIM
278	SP_LO_LIM
279	CHANNEL
280	FSAFE_TIME
281	FSAFE_VAL
282	BKCAL_OUT
283	RCAS_IN
284	SHED_OPT
285	RCAS_OUT
286	UPDATE_EVT
287	BLOCK_ALM
288	WSP
289	BLOCK_TEST
PID Function Block	
310	BLOCK
311	ST_REV
312	TAG_DESC
313	STRATEGY
314	ALERT_KEY
315	MODE_BLK
316	BLOCK_ERR
317	PV
318	SP
319	OUT
320	PV_SCALE
321	OUT_SCALE
322	GRANT_DENY
323	CONTROL_OPTS

Index	Parameter
324	STATUS_OPTS
325	IN
326	PV_FTIME
327	BYPASS
328	CAS_IN
329	SP_RATE_DN
330	SP_RATE_UP
331	SP_HI_LIM
332	SP_LO_LIM
333	GAIN
334	RESET
335	BAL_TIME
336	RATE
337	BKCAL_IN
338	OUT_HI_LIM
339	OUT_LO_LIM
340	BKCAL_HYS
341	BKCAL_OUT
342	RCAS_IN
343	ROUT_IN
344	SHED_OPT
345	RCAS_OUT
346	ROUT_OUT
347	TRK_SCALE
348	TRK_IN_D
349	TRK_VAL
350	FF_VAL
351	FF_SCALE
352	FF_GAIN
353	UPDATE_EVT
354	BLOCK_ALM
355	ALARM_SUM
356	ACK_OPTION
357	ALARM_HYS
358	HI_HI_PRI
359	HI_HI_LIM
360	HI_PRI
361	HI_LIM
362	LO_PRI
363	LO_LIM
364	LO_LO_PRI
365	LO_LO_LIM
366	DV_HI_PRI
367	DV_HI_LIM
368	DV_LO_PRI
369	DV_LO_LIM
370	HI_HI_ALM
371	HI_ALM

Index	Parameter
372	LO_ALM
373	LO_LO_ALM
374	DV_HI_ALM
375	DV_LO_ALM
376	PID_FORM
377	ALGO_TYPE
378	OUT_LAG
379	GAIN_NLIN
380	GAIN_COMP
381	ERROR_ABS
382	WSP
383	FUTURE
384	BLOCK_TEST
Resource Block	
400	BLOCK
401	ST_REV
402	TAG_DESC
403	STRATEGY
404	ALERT_KEY
405	MODE_BLK
406	BLOCK_ERR
407	RS_STATE
408	TEST_RW
409	DD_RESOURCE
410	MANUFAC_ID
411	DEV_TYPE
412	DEV_REV
413	DD_REV
414	GRANT_DENY
415	HARD_TYPES
416	RESTART
417	FEATURES
418	FEATURE_SEL
419	CYCLE_TYPE
420	CYCLE_SEL
421	MIN_CYCLE_T
422	MEMORY_SIZE
423	NV_CYCLE_T
424	FREE_SPACE
425	FREE_TIME
426	SHED_RCAS
427	SHED_ROUT
428	FAIL_SAFE
429	SET_FSAFE
430	CLR_FSAFE
431	MAX_NOTIFY
432	LIM_NOTIFY
433	CONFIRM_TIME

Index	Parameter
434	WRITE_LOCK
435	UPDATE_EVT
436	BLOCK_ALM
437	ALARM_SUM
438	ACK_OPTION
439	WRITE_PRI
440	WRITE_ALM
441	DL_CMD1
442	DL_CMD2
443	DL_APPSTATE
444	DL_SIZE
445	DL_CHECKSUM
446	REVISION_ARRAY
447	BLOCK_TEST
448	ERROR_DETAIL
Transducer Block	
460	BLOCK
461	ST_REV
462	TAG_DESC
463	STRATEGY
464	ALERT_KEY
465	MODE_BLK
466	BLOCK_ERR
467	UPDATE_EVT
468	BLOCK_ALM
469	TRANSDUCER_DIRECTORY
470	TRANSDUCER_TYPE
471	XD_ERROR
472	COLLECTION_DIRECTORY
473	FINAL_VALUE
474	FINAL_VALUE_RANGE
475	FINAL_VALUE_CUTOFF_HI
476	FINAL_VALUE_CUTOFF_LO
477	FINAL_POSITION_VALUE
478	SERVO_GAIN
479	SERVO_RESET
480	SERVO_RATE
481	ACT_FAIL_ACTION
482	ACT_MAN_ID
483	ACT_MODEL_NUM
484	ACT_SN
485	VALVE_MAN_ID
486	VALVE_MODEL_NO
487	VALVE_SN
488	VALVE_TYPE
489	XD_CAL_LOC
490	XD_CAL_DATE
491	XD_CAL_WHO

Table 8.21 Block Parameter Index Table (2 of 2)

Index	Parameter
492	DAC_PERCENT
493	CONTROL_FLAGS
494	GAIN_UPPER
495	GAIN_LOWER
496	GAIN_MULT
497	IGAIN
498	IL_OFFSET
499	STATUS_FLAGS
500	CMD_USED
501	CALIBRATE
502	DAC_VALUE
503	PRESS_CAL
504	CALIBRATE_FLAGS
505	SOFTSTOP_HIGH
506	SOFTSTOP_LOW
507	CYCLE_COUNTER
508	CYCLE_DEADBAND
509	CYCLE_LIMIT
510	TRAVEL_ENG
511	TRAVEL_DEADBAND
512	TRAVEL_ALERT
513	STROKE_ENG
514	TRAVEL_UNITS
515	CURVEX
516	CURVEY
517	TRAVEL_FLAGS
518	TEMPERATURE
519	TOP_PRESSURE
520	BOTTOM_PRESSURE
521	SUPPLY_PRESSURE
522	VOLTAGE_REFERENCE
523	HALL_SENSOR
524	DAC_CHECK
525	MOD_CURRENT
526	IL_CHK
527	INTERNAL_FLAGS
528	PRESS_FLAGS
529	PRESS_UNITS
530	TEMP_UNITS
531	ELECTRONICS_SN
532	SOFTWARE_VER

Index	Parameter
533	FAIL_MODE
534	AD_RAW_FB
535	ERROR
536	PGAIN
537	INTEGRAL_SUM
538	ALPHA_FILT
539	PRESS_WINDOW
540	PRESS_HYST
541	PRESS_GAIN
542	TP_ZERO
543	TP_SPAN
544	TP_FULL_SCALE
545	BP_ZERO
546	BP_SPAN
547	BP_FULL_SCALE
548	SP_ZERO
549	SP_SPAN
550	SP_FULL_SCALE
551	FB_ZERO
552	FB_SPAN
553	FB_SCOUNT
554	HALL_NULL
555	HALL_DOWN
556	HALL_UP
557	POSALERT_HIGH
558	POSALERT_LOW
559	POSDEV_DEADBAND
560	POSDEV_TIME
561	SIG_START
562	SIG_STOP
563	RAMP_RATE
564	STEP_TIME
565	SIG_FLAGS
566	SAMPLE_TIME
567	SIG_COUNTER
568	INTAD_RAW1
569	INTAD_RAWTP
570	INTAD_RAWBP
571	INTAD_RAWSP
572	INTAD_RAW3
573	INTAD_RAW4

Index	Parameter
574	INTAD_RAW5
575	INTAD_RAW6
576	INTAD_RAW8
577	TEST_MODE
578	VALVE_SIZE
579	VALVE_CLASS
580	VALVE_ENDCON
581	VALVE_BODYMAT
582	VALVE_TRIMMAT
583	VALVE_TRIMCHAR
584	VALVE_TRIMTYPE
585	VALVE_TRIMNO
586	VALVE_PACKTYPE
587	STROKE_OPENTIM
588	STROKE_CLOSEDTIM
589	STROKE_TSTPSI
590	STEM_DIAM
591	LEAK_CLASS
592	INLET_PRESS
593	OUTLET_PRESS
594	VALVE_FLAGS
595	RATED_TRAV
596	ACT_TYPE
597	ACT_SIZE
598	SPRING_TYPE
599	SPOOL_ID
600	PO_DATE
601	INSTALL_DATE
602	LOAD_EE_DEFAULTS
603	ENG_RELEASE_NUM
604	MISC_FLAGS
605	SIG_INDEX
606	SIG_DATA
607	MFG_PHONE
608	PUR_ODER_NUM
609	GENERIC_PARM_NUM
610	GENERIC_PARM_VAL
611	SPI_TEST_RCV
612	SPI_TEST_TX
613	BLOCK_TEST

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8.17 Management Virtual Field Device

VFD

Refer to FF documentation for details about this Virtual Field Device (VFD).

8.18 System Management

Description

System Management (SM) operates on special objects in the System Management Information Base (SMIB) which is part of the Management Virtual Field Device (VFD).

System Management Key Features

The key features of system management operation:

- Provide system application clock time synchronization
- Provide scheduling of function blocks
- Manage automatic device address assignment
- Provide tag search service

System Management Information Base (SMIB)

The SMIB contains various objects that are associated with system management operation. Table 8.22 shows a listing of the SMIB object dictionary. Groups of objects (along with their starting index number) are included in the SMIB for the Logix 1400 digital positioner. The numbers in parenthesis indicate the number of objects.

Table 8.22 Logix 1400 Digital Positioner SMIB Object Dictionary

Dictionary Index	Object
Header	Reserved
	Directory of Revision Number (1)
	Number of Directory Objects (1)
	Total Number of Directory Entries (5)
	Directory Index of First Composite List Reference (0)
	Number of Composite List References (0)
258	System Management Agent Starting OD Index
	Number of System Management Agent Objects (4)
262	Sync and Scheduling Starting OD Index
	Number of Sync and Scheduling Objects (8)
270	Address Assignment Starting OD Index
	Number of Address Assignment Objects (3)
273	VFD List Starting OD Index
	Number of VFD List Objects (2)
275	FB Schedule Starting OD Index
	Number of FB Schedule Objects (2)

Supported Features

The features supported by system management include the key features listed above as well as the ones designated in Table 8.23. The object SM_SUPPORT indicates which features are supported by system management in the FBAP. The features are mapped to the bits in the bit string shown below.

Table 8.23 System Management Supported Features

SM_SUPPORT bit	Feature	Supported?	
0	Set physical device tag (agent)	yes	
1	Set field device address (agent)	yes	
2	Clear address (agent)	yes	
3	Identify (agent)	yes	
4	Locating function blocks (agent)	yes	
5	Set physical device tag (manager)		no
6	Set field device address (manager)		no
7	Clear address (manager)		no
8	Identify (manager)		no
9	Locating function blocks (manager)		no
10	FMS server role	yes	
11	Application clock synch (time slave)	yes	
12	Scheduling function block	yes	
13	Application clock synch (time publisher)		no
14 to 31	*Reserved for future use.*		no

SM_SUPPORT Bits

Any bit (of the object SM_SUPPORT) will be set that corresponds to a supported feature listed in Table 8.23.

The resulting value in the object SM_SUPPORT is 1C1F (hex).

SM Agent Objects

Four SM agent objects are contained in the SMIB object dictionary. One object, SM_SUPPORT, was described previously. The three other objects are timers associated with SM operations. Table 8.24 identifies the SM Agent objects with their object directory index and default values.

Table 8.24 SM Agent Objects (1 of 2)

Object	Description	OD Index	Default Value
SM_SUPPORT	Variable that indicates the features supported by SM in this device. See Table 8.22, *Logix 1400 Digital Positioner SMIB Object Dictionary,* on page 87.	258	0x1C1F
T1	Value of the SM step timer in 1/32 of a millisecond ticks.	259	96,000* (3 seconds)
T2	Value of the SM set address sequence timer in 1/32 of a millisecond ticks.	260	1,920,000* (60 seconds)

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Table 8.24 SM Agent Objects (2 of 2)

Object	Description	OD Index	Default Value
T3	Value of the SM set address wait timer in 1/32 of a millisecond ticks.	261	480,000 * (15 seconds)

* The default value is specified by the communications profile for the application area

System Application Clock Time Synchronization

Each link in a fieldbus network contains an application clock time publisher responsible for distributing application time on the link.

A clock synchronization message is periodically sent by the time publisher to all fieldbus devices. The application clock time is independently maintained in each device based on its own internal crystal clock.

Clock synchronization provides the capability for devices to time stamp data (events and alarms when they occur).

Sync and Scheduling Objects

These objects are used by system management to provide application clock synchronization and macro cycle scheduling for the device. Table 8.25 identifies the sync and scheduling objects with their object directory index and default values.

Table 8.25 SM Sync and Scheduling Objects

Object	Description	OD index	Default Value
CURRENT_TIME	The current application clock time.	262	Dynamic
LOCAL_TIME_DIFF	Used to calculate local time from CURRENT_TIME.	263	0
AP_CLOCK_SYNC_ INTERVAL	The interval in seconds between time messages on the link (bus).	264	Set by SM (mgr.) during address assignment
TIME_LAST_RCVD	The application clock time contained in the last clock message.	265	Dynamic
PRIMARY_AP_TIME_ PUBLISHER	The node address of the primary time publisher for the local link (bus).	266	Set by SM (mgr.) during address assignment
TIME_PUBLISHER_ ADDR	The node address of the device which sent the last clock message.	267	Dynamic
Unused		268	
MACROCYCLE_ DURATION	The length of the macro cycle in 1/32 of a millisecond ticks.	269	Set by SM (mgr.) during address assignment

Device ID, Tag Name and Device Address

Each fieldbus device on the network is uniquely identified by:

- Device ID that is set by the manufacturer to identify the device.
- Device Name (Tag) - set by the user to identify operation.
- Device Address - a unique numerical address on the fieldbus segment. Address may be set automatically by system management.

Address Assignment Objects

Table 8.26 is a description of the address assignment objects with their object directory index and default values.

Table 8.26 SM Address Assignment Objects

Object	Description	OD index	Default Value
DEV_ID	The device ID set by the manufacturer.	270	464C530201-VAL-LX1400-0nnnnnnn
PD_TAG	The physical device tag to be set using SET_PD_TAG service.	271	All Spaces
OPERATIONAL_POWERUP	Controls the state of SM of the device upon power-up.	272	TRUE (SM goes operational after power up)

Virtual Field Device (VFD) List Objects

Two objects identify the VFDs in the device:

OD Index	VFD_REF	VFD_TAG
273	1	'MIB'
274	2	'Resource'

Function Block Scheduling

The SMIB contains a schedule, called the function block schedule, that indicates when that device's function blocks are to be executed.

System Management schedules the start of each function block relative to the macro cycle of the device. The macro cycle represents one complete cycle of the function block schedule in a device. The macro cycles of all devices on the link are synchronized so that function block executions and their corresponding data transfers are synchronized in time.

Using the configurator software, the device's function block schedule can be pre-configured.

Function Block Scheduling Objects

Four scheduling objects are defined in the Logix 1400 digital positioner. Table 8.27 lists the function block scheduling objects with their object directory index and default values.

Table 8.27 Function Block Scheduling Objects

Object	Description	OD Index	Default Value
VERSION_OF_SCHEDULE	The version number of the function block schedule.	275	0
FB Schedule Entry #1	Default setting is the AO block	276	START_TIME_OFFSET - 0 FB_OBJECT_INDEX - 257 VFD_REF - 1
FB Schedule Entry #2	Default setting in the PID block	277	START_TIME_OFFSET - 16000 FB_OBJECT_INDEX - 310 VFD_REF - 1
FB Schedule Entry #3		278	0xFFFFFFFF
FB Schedule Entry #4	Available	279	0

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8.19 Network Management

Description

Network management provides for the management of a device's communication system by an external network manager application.

Network management operates on special objects in the Network Management Information Base (NMIB) which is part of the Management Virtual Field Device (VFD).

Network Management Features

Network Management provides the following features:

Loading a Virtual Communication Relationship (VCR), which may be a list or a single entry. See VCR list objects.

- Loading/changing the communication stack configuration
- Loading the Link Active Schedule (LAS)
- Performance monitoring

Network Management Objects

Normally, most of the network management objects appear transparent to the user. In other words, the parameters and objects used for network management are not normally viewed or changed as part of device configuration.

The network management objects in the Logix 1400 digital positioner FBAP are listed in the following paragraphs, although most, (if not all) of these objects are not directly user-configured.

Network Management Information Base (NMIB)

The NMIB contains various objects that are associated with network management operation. Table 8.28 lists the NMIB object dictionary. The groups of network management objects (along with their index starting numbers) are included in the NMIB for the Logix 1400 digital positioner. The numbers in parenthesis indicate the number of objects.

Table 8.28 Logix 1400 Digital Positioner NMIB Object Dictionary (1 of 2)

Dictionary Index	Object
Header	Reserved
	Directory of Revision Number
	Number of Directory Objects
	Total Number of Directory Entries
	Directory Index of First Composite List Reference
	Number of Composite List References
290	Stack Management OD Index
	Number of Objects in Stack Management (1)
291	VCR List OD Index
	Number of Objects in VCR List (5)
330	DLL Basic OD Index
	Number of Objects in DLL Basic (3)
332	DLL Link Master OD Index
	Number of Objects in DLL Link Master (7)
340	Link Schedule OD Index
	Number of Objects in Link Schedule
Not Used	DLL Bridge OD Index
	Number of Objects in DLL Bridge

Table 8.28 Logix 1400 Digital Positioner NMIB Object Dictionary (2 of 2)

Dictionary Index	Object
337	Phy LME OD Index
	Number of Objects in Phy LME (2)

Virtual Communications Reference (VCR) Objects

The objects listed above contain parameters which define network management operations. These operations include communications between applications in different field devices (or field devices and operator interface). In order for this communication to take place, a communications relationship must be set up using the network management objects and parameters. The parameters for this communication relationship are stored in a Virtual Communications Reference (VCR) object.

VCR Attributes

The attributes for the VCR types (VCR name) defined in the Logix 1400 digital positioner device are standard fieldbus attributes. For detailed descriptions of these attributes, see *FOUNDATION fieldbus Specification Network Management, document FF-801*, available from the Fieldbus Foundation.

Unsupported Services

The following is a list of services which are not supported (not used) in the Logix 1400 digital positioner FBAP:

- FB_Action (all function blocks are static)
- Put_OD (all ODs are static)
- Domain upload
- Program invocation
- Reception of alert and trend indications
- Access protection and check of password
- AlertEventConditionMonitoring
- Write to variable lists
- Create/Modify/Delete variable lists
- Read and write access by name
- PhysRead, PhysWrite
- ReadWithType, WriteWithType
- InformationReportWithType

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8.20 Logix 1400 Digital Positioner Variable Enumeration

The following list defines the Logix 1400 digital positioner variables enumeration.

CALIBRATE: This variable initiates calibration procedures, and reports current state of calibration during the procedure.

Value	Function
0	Normal operation, position control enabled
1	Automatically calibrate stroke, Re-Cal stroke
2	Automatically calibrate actuator pressure sensors
*5	Moving valve to closed position, get feedback at 0%
*6	Moving valve to open position, get feedback at 100%
*7	Calibrating SUPPLY sensor
*8	Moving valve to closed position, calibrating actuator sensor
*9	Moving valve to open position, calibrating actuator sensor
*11	Check that Re-Cal button is depressed
*12	Error occurred during calibration
*16	Automatically determine inner-loop offset
18	Perform step time test

* Read-only — user cannot send CALIBRATE in this mode.

CALIBRATE_FLAGS: Each bit within this variable is a flag indicating parameters relevant to calibration. A logic 1 indicates error is active.

Bit	Description
0	0=No error 1= Calibration time-out
1	
2	0= No error 1= Position A/D converter saturated at 0% position
3	0= no error 1= Position A/D converter saturated at 100% position
4	
5	0= No error 1= Position A/D converter span error
6	
7	0= No error 1= Step time test time-out

CONTROL_FLAGS: Each bit within this variable is a flag that indicates parameters relevant to position control and calibration.

Bit	Name	Action
0	Air Action	0 = ATO 1 = ATC
1	Fail Position	TBD
2	Characterization Active	0 = Linear stem positioning 1 = Custom characterization stem positioning
3	Actuator Gains	0 = Linear actuator gains used 1 = Rotary actuator gains used
4	Model	0 = Standard positioner model (no pressure sensors) 1 = Advanced positioner model (pressure sensors)
5	Actuator Type	0 = Double-acting actuator type (piston) 1 = Single-acting actuator type (diaphragm)
6	Equal-percent Curve	0 = Use custom curve (user may edit) 1 = Use default equal-percent curve
7	Quick-opening Curve	0 = Use custom curve (user may edit) 1 = Use default quick-opening curve

NOTE: When bit 2 is set, if bit 6 and 7 = 0, the positioner will use the custom modifiable curve. The code will prevent both bits from being set at the same time. When bit 2 is set, if either bit 6 or 7 are set, the corresponding default characterization curve will be used. If bit 2 = 0, the positioner will use linear stem positioning, regardless of the value of bits 6 and 7.

FAIL_MODE: This variable is used to indicate the desired fail action of the Logix digital position should a loss of communications occur. *If this variable = 0x00, the fail action will be 'last known position.'* Logix software prevents more than 1 bit being set at a time.

Bit	Description
0	1 = Fail to last commanded position
1	1 = Fail valve to closed (0%) position
2	1 = Fail valve to full opened (100%) position

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INTERNAL_FLAGS: Each bit within this variable is a flag indicating parameters relevant to the internal operation of the positioner electronics. A logic 1 indicates error is active.

Bit	Description
0	0 = No error 1 = 12 bit A/D reference error
1	0 = No error 1 = 1.23V reference error
2	0 = No error 1 = 12 bit DAC error
3	0 = No error 1 = Temperature error
4	0 = No error 1 = Hall Sensor error
5	0 = No error 1 = Excessive modulator current
6	0 = No error 1 = Inner loop error
7	0 = No error 1 = EEPROM checksum error

LOAD_EE_DEFAULTS: This variable will load the positioner's card EEPROM with factory default values.

Value	Function
1	Reset variables
2	Reset calibration constants

MISC_FLAGS: This bit mapped variable is used to enable/disable various features of the Logix 1400 digital positioner. The user does not view it.

Bit	Name	Function
0	Re-Cal Disable	0 = Re-Cal enabled 1 = Re-Cal disabled
1	Large Act. Cal Enable	0 = Normal calibration 1 = Large actuator calibration
2	Auto Model Detect Disable	0 = Auto model detect enabled 1 = Auto model detect disabled
3	Reserved	
4	Not used	
5	Not used	
6	Not used	
7	Not used	

PRESS_FLAGS: Each bit within this variable is a flag indicating parameters relevant to the pressure sensors (Advanced model ONLY). A logic 1 indicates error is active.

Bit	Description
0	0 = No error 1 = Loss of supply
1	0 = No error 1 = Supply sensor Failure (low pressure reading during calibration)
2	0 = No error 1 = Output port 1 sensor failure (low pressure reading during calibration)
3	0 = No error 1 = Output port 2 sensor failure (low pressure reading during calibration)
4	Not used
5	Not used
6	Not used
7	Not used

PRESS_UNITS: This is an enumerated byte that indicates the engineering units being utilized for pressure sensor reporting. The embedded code supports units of psig, barg, KPag, and Kg/cm^2g. The unit codes are defined as follows:

- 6 = psi
- 7 = bar
- 10 = Kg/cm^2
- 12 = Kpa

SIG_FLAGS: Byte which will be added to the end of each signature data frame to show progress and end-of-signature. One flag will set STEP or RAMP STATUS_flags

Status flag variables for fieldbus. When a bit is set, the corresponding flag variable is reporting an alarm condition.

Bit	Description
0	0 = No error 1 = Error reported in CALIBRATE flags
1	0 = No error 1 = Error reported in TRAVEL flags
2	0 = No error 1 = Error reported in INTERNAL flags
3	0 = No error 1 = Error reported in PRESSURE flags
4	0 = No error 1 = Communications error
5	Not used
6	Not used
7	Not used

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TEMP_UNITS: This is an enumerated byte that indicates the engineering units being utilized for temperature reporting. The embedded code supports °C and °F. The unit codes are defined as follows:

- 32 = °C
- 33 = °F

TEST_MODE: This variable is bit mapped variable that will allow special tests to be done to the positioner.

Bit	Test
0	DAC control given to PC, write to DAC_value
1	Blink red LED, used for electronics board test. Bits 2 & 3 may not be set when active
2	Blink yellow LED, used for electronics board test. Bits 1 & 3 may not be set when active
3	Blink green LED, used for electronics board test. Bits 1 & 2 may not be set when active
4	Reserved
5	Reserved
6	Reserved
7	Enable diagnostic scan list

TRAVEL_FLAGS: Each bit within this variable is a flag indicating errors or alerts related to valve travel. Logic one indicates the flag is active.

Bit	Description
0	0 = No alert 1 = Final_Value_Cutoff active (this can be either high or low)
1	0 = No alert 1 = Lower soft stop active
2	0 = No alert 1 = Upper soft stop active
3	0 = No alert 1 = Lower position alert
4	0 = No alert 1 = upper position alert
5	0 = No alert 1 = Cycle counter limit exceeded
6	0 = No alert 1 = Travel accumulator limit exceeded
7	0 = No alert 1 = Position deviation alert

TRAVEL_UNITS: This is an enumerated byte that indicates the engineering units being utilized for the travel accumulator and stroke. The unit codes are defined as follows:

- 47 = inches
- 49 = millimeters

Section 9: Calibration

9.1 Introduction

About This Section

This section provides information about calibrating the Logix 1400 digital positioner's sensors.

9.2 Overview

About Calibration

When re-calibration is required, the Logix 1400 digital positioner does not need to be removed from the process and may be calibrated in the field.

NOTE: Calibration will cause the valve to fully stroke, so calibration must not be initiated while the valve is on line in the process.

The NI-FBUS Configurator application can be used to perform the calibration procedures. The software application is not a calibrated measurement source. It is a digital diagnostic tool that provides verification of device parameter values.

Calibration Process

In general, calibration procedures follow these processes:

1. Prepare the device. **(NOTE: The transducer function block must be out-of-service in order to perform any calibration.)**
2. Write to CALIBRATE.
3. Observe the positioner performance.

The calibration parameter values and calibration commands are written to the device using a fieldbus configuration application, (such as the NI-FBUS Configurator).

Alternatively, use the *Re-Cal* button on the Logix 1400 digital positioner to perform the stroke calibration. Confirm that positioner is configured properly, then proceed.

1. Prepare the device and safe the area for the removal of the main housing cover.
2. Remove the cover.
3. Press and hold the *Re-Cal* button for at least five seconds to initiate the stroke calibration. (**NOTE: The transducer block must be out-of-service before the *Re-Cal* button will be active.)**
4. Replace cover and return to operation.

(Refer to *Logix 1400 Digital Positioner* IOM for more details.)

9.3 Calibration

The output position of the Logix 1400 digital positioner is calibrated using the transducer block CALIBRATE parameter. The positioner performance must be verified by the operator.

Calibration Parameters

Table 9.1 lists transducer block parameters and their values used in the calibration procedures.

Table 9.1 Transducer Block Calibration Parameters

Parameter	Description	Value - Meaning	Comments
MODE_BLK	The operating mode of the transducer block	Permitted modes: Auto — Auto (target mode) OOS — Out of Service	The transducer block must be in the OOS mode to perform Logix 1400 digital positioner calibration.
CALIBRATE	One-byte value which selects the calibration operation to be performed.	0 Normal operation. Valve tracks FINAL_VALUE 1 Initiates stroke calibration. Closes valve. 2 Initiates actuator pressure transducers calibration. 6 Open valve and read position ADC 8 Read pressure transducers ADC at closed position. 9 Move valve to open position and read pressure transducers ADC values at open position. 10 Manual control of DAC. Allows user control of spool position by writing to DAC_VALUE. 11 Monitoring of *Re-Cal* button. 12 Error occurred during calibration. 13 Force red LED to blink 14 Force yellow LED to blink 15 Force green LED to blink 16 Inner-loop offset adjustment 17 Perform stop time test	Calibration and correction commands are executed when the command is written. Initiates the monitoring of the button for five seconds Nulls the spool block Initiates a step time test and stores data in STROKE_OPENTIM and STROKE_CLOSEDTIM
PRES_CAL	Input supply pressure for calibration	0 – 150 psig max.	Used to calibrate the span of the actuator pressure sensors

Two-point Calibration

The Logix 1400 digital positioner has two-point calibration. The stroke position feedback potentiometer and the actuator pressure transducers are calibrated this way.

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The positioner must be pre-configured to the proper air action, valve type (linear or rotary), positioner model (standard or advanced) before the calibration is done. (CONTROL_FLAGS =16 -> Air to Open, Linear, Advanced = default values)

Procedure

Stroke and pressures are calculated when the user follows the steps below.

1. Using a fieldbus configuration application as the operator interface to device, set the transducer block MODE_BLK parameter to OOS (Out of Service).
2. For stroke, write the value 1 to CALIBRATE. The valve will close and then open automatically. The value will change to 6 and then 16 as the calibration continues. Once completed, CALIBRATE will return to '0.' (This may take 10 seconds to 2 minutes depending on the actuator size.)
3. For actuator pressure transducers (if so equipped), input the measured supply pressure (in psig) in PRES_CAL. Write the value 2 to CALIBRATE. The valve will close and then open automatically. The value will change to 8 and then 9 as the calibration continues. Once completed, CALIBRATE will return to '0.'
4. The positioner will return to tracking FINAL_VALUE.
5. Change MODE_BLK to desired mode
6. When calibration is completed, set transducer block to auto mode to resume normal device operation.

Canceling Calibration

Write ABORT to CALIBRATE. The previous values are restored and CALIBRATE returns to NONE.

Additional Calibration Features

Re-Cal button: Re-Cal is a method by which the valve can be stroke-calibrated without using the fieldbus configurator. ***Important: This feature is provided to allow stroke calibration being initiated at the positioner. However, the Logix 1400 digital positioner Transducer block must be placed in Out-of-Service mode for the button to become active. After completion of the calibration cycle, the block must be returned to normal mode for operation to resume.***

Re-Cal **only** affects position calibration. Any previous configuration or stored information is not affected.

Position 0 percent Calibration Flag: During stroke calibration, the Logix 1400 digital positioner checks to see if the linkage is placing the stem position sensor in range. If the valve stroke causes stem position measurement to go out of range in the closed position, a 'Position 0 percent Flag' will be generated. The valve stem will stop in the closed position and the red LED will blink. Linkage must be adjusted to bring the sensor in range. *Special LED indication: If the linkage is out of range, the LEDs can be used as an adjustment guide. The LED will change from a red to yellow when the linkage is brought into range. Refer to IOM for additional information.*

Position 100 percent Calibration Flag: During stroke calibration, the Logix 1400 digital positioner checks to see if the linkage is placing the stem position sensor in range. If the valve stroke causes stem position measurement to go out of range in the open position, a 'Position 100 percent Flag' will be generated. The valve stem will stop in the open position and the red LED will blink. Linkage must be adjusted to bring the sensor in range. *Special LED indication: If the linkage is out of range, the LEDs can be used as an adjustment guide. The LED will change from a red to yellow when the linkage is brought into range.*

Position Span Flag: Position span is a check during stroke calibration to verify that the valve stem moved. The algorithm waits to see if no movement is detected when the valve is automatically stroked open. Anything that could prevent the valve from stroking will generate a position span error (no supply pressure, malfunctioning spool valve).

Section 10: Troubleshooting

10.1 Introduction

About This Section

This section contains information about identifying device faults and suggested actions to correct them. The approach to troubleshooting is determining the cause of the fault through definition of the symptoms (such as a device not visible on network or not able to write values to parameters).

The information is organized the following way:

- **Device troubleshooting tables** list some of the more commonly encountered faults and suggestions to check in order to find out where the problem is and correct it.
- **Positioner status tables** define some of the conditions that cause critical or non-critical faults in the transmitter. **Critical and non-critical faults** are described and suggestions are given on where to find further information.
- **Device diagnostics** briefly explains about some of the background diagnostics that are active in the device during normal operation. Device parameters are described that provide information about hardware and software status within the device.
- **Block configuration errors** summarize conditions within the device which may be caused by configuration errors and suggestions on where to look to correct the errors.
- **Simulation mode** describes how to set up the transmitter to generate a user-defined simulated input. This feature is useful in debugging the system when the process is not running.

10.2 Overview

Device Status and Failures

Logix 1400 digital positioner is constantly running internal background diagnostics to monitor the functions and status of device operation. When errors and failures are detected, they are reported in the status bits of various parameters in each block object, e.a. BLOCK_ERR or ERROR_DETAIL. Other parameters can be viewed showing a status description and/or a value which may identify a fault.

Device status and certain operational faults are identified by viewing the parameter status or values and interpreting their meaning using the tables in this section.

Additional diagnostics may be available through supervisory and control applications that monitor and control fieldbus networks. These diagnostics and messages are dependent upon the capabilities of the application and control system used.

Troubleshooting with the NI-FBUS Configuration Tool

The diagnostic messages generated by the Logix 1400 digital positioner and block parameters can be accessed and evaluated using the NI-FBUS Configurator. Troubleshooting of some Logix 1400 digital positioner faults and corrective actions also can be performed using the configurator.

Fault Summary

Diagnostic messages can be grouped into one of these three categories.

1. **Non-critical Failures** —Logix 1400 digital positioner continues to calculate PV output.
2. **Critical Failures** —Logix 1400 digital positioner drives PV output to fail-safe state.
3. **Configuration Errors** —Incorrect parameter values may cause the Logix 1400 digital positioner to generate a fault.

A description of each condition in each category is given in the following tables. The condition is described, a probable cause is stated and a recommended corrective action is given for each fault.

10.3 Device Troubleshooting

Device Not Visible on Network

If the device is not seen on the fieldbus network, the device may not be powered up or possibly the supervisory or control program is not looking for (or polling) the node address of that device. (See Table 10.1 for possible causes and recommended actions.)

Table 10.1 Device Troubleshooting A (1 of 2)

Symptom		
• Device not visible on network		
Possible Cause	**Items to Check**	**Recommended Action**
Device may have a node address that is within the unpolled range of addresses.	Look at the following settings of the host system: • First Unpolled Node • Number of Unpolled Nodes	Set number of unpolled nodes to 0.
No power to the device.	Measure the DC voltage at the device's SIGNAL terminals. Voltage must be within the limits as shown in Table 4.2 on page 15.	If no voltage or voltage is out of operating limits, determine cause and correct.
Incorrect polarity at device terminals.	Check for proper voltage polarity to the device. • Fieldbus wire + to SIGNAL + • Fieldbus wire - to SIGNAL -	Correct the wiring to device terminals, if necessary.
Insufficient current to device	Measure DC current to device. It should be between 23 and 27 mA.	If current is insufficient, determine cause and correct.
More than two or less than two terminators wired to fieldbus link	Check to see that only two terminators are present on link.	Correct, if necessary.

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Table 10.1 Device Troubleshooting A (2 of 2)

Symptom		
• Device not visible on network		
Possible Cause	**Items to Check**	**Recommended Action**
Insufficient signal to device	Measure the peak-to-peak signal amplitude; it should be: • Output 0.75 to 1.0 Vp-p. • Input 0.15 to 1.0 Vp-p. Measure the signal on the + and - SIGNAL terminals and at a frequency of 31.25k Hz.	If signal amplitude is insufficient, determine the cause and correct.

Incorrect or Non-compatible Tools

If the user is using non-compatible versions of fieldbus software tools, such as Standard Dictionary or Device Description (DD) files, or if the user is using the incorrect revision level of device firmware, then device objects or some block objects may not be visible or identified by name. (See Table 10.2 for possible causes and recommended actions.)

Table 10.2 Device Troubleshooting B (1 of 2)

Symptom		
• Device and/or block objects not identified (UNKnown), or, • Parameters are not visible or identified by name, or • Flowserve-defined parameters are not visible.		
Possible cause	**Items to check**	**Recommended Action**
Incorrect standard dictionary, device description (DD) or symbols on host computer	Verify that the standard dictionary, the DD or symbols files are correct for the device.	Install the compatible version of standard dictionary and DD for the device on the host computer. See *Fieldbus Device Version Checking* on page xi.
Incorrect path-names to descriptions on host computer.	Check that the path name to locations of the standard dictionary, and DD files on the host computer is correct.	Make sure that the path name of the standard dictionary and DD are in the correct location for the fieldbus software application. (C:\. . . \release\)
Incorrect revision of *Device Resource Block* firmware	Read the following resource block parameters: • DEV_REV (contains the revision level of the resource block). • DD_REV (contains the revision level of the resource block).	Perform a code download of the correct device firmware. See *Code Download* on page 133.

Table 10.2 Device Troubleshooting B (2 of 2)

Symptom		
• Device and/or block objects not identified (UNKnown), or, • Parameters are not visible or identified by name, or • Flowserve-defined parameters are not visible.		
Possible cause	**Items to check**	**Recommended Action**
Incorrect revision level of the device firmware.	Read the three elements of the REVISION_ARRAY parameter, which are: • Stack board firmware • Stack board boot code • Transducer board firmware **NOTE:** The numbers, when viewed as hexadecimal numbers, are in the format MMmm. Where, MM is the major revision number and mm is the minor revision number.	Perform a code download of the correct device firmware. See *Code Download* on page 133.

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Non-functioning Blocks

- Device block objects may not be running (executing their function block schedules) or the blocks may be in Out-of-Service (OOS) mode. For example, if the AO function block is in OOS mode, the block will not provide updated output values although the AO block may be running. When troubleshooting non-functioning block objects, start with the resource block. For example, if the resource block is in OOS mode all other blocks in the device will also be in OOS mode. (See Table 10.3 for possible causes and recommended actions.)

Table 10.3 Device Troubleshooting C (1 of 2)

Symptom		
• Device output is not updating.		
Possible cause	**Items to check**	**Recommended Action**
Resource block mode is OOS	Read MODE_BLOCK. ACTUAL of Resource block.	If necessary, set MODE_BLOCK.TARGET to Auto.
Resource block is not running.	Read the first element of BLOCK_TEST. Number should be increasing indicating that block is running. If block is not running, check the second element of BLOCK_TEST.	If second element of BLOCK_TEST is not zero, write all zeroes to element.
	Check BLOCK_ERR for other errors.	See Sub-section 10.7 for details on BLOCK_ERR.
	If an error is present in BLOCK_ERR, then read ERROR_DETAIL.	See Sub-section 10.7 for details on ERROR_DETAIL parameter.
		Set RESTART to processor (or '4') to soft-restart the device.
Incorrect revision of resource block firmware.	Read DEV_TYPE , DEV_REV, and DD_REV.	See *Incorrect or non-compatible tools* above in Sub-section 10.3.
Incorrect revision level of the device firmware.	Read REVISION_ARRAY.	See *Incorrect or non-compatible tools* above in Sub-section 10.3.
Transducer block mode is OOS	Read MODE_BLK . ACTUAL.	Set MODE_BLK.TARGET to auto. NOTE: Transducer block must be in auto mode for the sensor signal to be passed to 'AO block.'

Table 10.3 Device Troubleshooting C (2 of 2)

Symptom		
• Device output is not updating.		
Possible cause	**Items to check**	**Recommended Action**
Transducer block is not producing valid primary data.	**1.** Read the first element of BLOCK_TEST. Number should be increasing indicating that block is running. If block is not running, check the second element of BLOCK_TEST.	If second element of BLOCK_TEST is not zero, write all zeroes to element.
	2. Read BLOCK_ERR.	See Sub-section 10.7 for details on BLOCK_ERR.
	3. Verify parameter FINAL_VALUE is not valid STATUS = *good* or *uncertain* VALUE = active	Isolate valve from process and check calibration.
	4. Read FINAL_POSITION VALUE; should contain the position.	Report information to factory.
Analog Output block mode is OOS	Read MODE_BLK.ACTUAL of AO block.	Set MODE_BLK .TARGET to auto.
AO block is not initialized	**1.** CHANNEL **2.** SHED_OPT	**1.** Set to 1 **2.** Set to a value other than Un-initialized
PID block is not initialized	SHED_OPT	Set to a value other than uninitialized.
PID block mode is OOS	Read MODE_BLK.ACTUAL of PID block.	Set MODE_BLK.TARGET to Auto.
PID block is not running.	Read the first element of BLOCK_TEST. Number should be increasing indicating that block is running. If block is not running, check the second element of BLOCK_TEST.	If second element of BLOCK_TEST is not zero, write all zeroes to element.
	Read BLOCK_ERR.	See Sub-section 11.7 for details on BLOCK_ERR.
PID block is not initialized.	Read parameters: BYPASS SHED_OP	The default values of these parameters are configuration errors and they must be set to a valid range. See *Clearing Block Configuration Errors*, Sub-section 11.9.
	Read parameters: IN.STATUS should be set to ‘good’ OUT.STATUS should be set to ‘good’	

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10.4 Device Diagnostics

Logix 1400 Digital Positioner Memory

The Logix 1400 digital positioner contains a number of areas of memory. An EEPROM provides a non-volatile memory area for static and non-volatile parameter values. The positioner also contains areas of RAM and ROM.

Background Diagnostics

Block objects (resource, transducer and function blocks), the communications stack and other device objects each have a designated area of memory where their database resides. Diagnostic routines are performed in the background during device operation which check the integrity of these individual databases. When a failure is detected, a status bit is set in the BLOCK_ERR parameter in the appropriate block object.

Diagnostic checks are performed continuously on the device functional databases of the transmitter application shown in Table 10.4.

Table 10.4 Areas of Device Memory Where Data is Stored

Device Functional Area	Location
Block object database (DB)	RAM and EEPROM
Communication stack database (DB)	RAM and EEPROM
Boot ROM	ROM
Program ROM	ROM
Trend and link object databases (DB)	RAM and EEPROM

BLOCK_ERR Parameter

BLOCK_ERR parameter shows diagnostic faults of hardware and software components within the transmitter. Each block object in the transmitter device application contains a BLOCK_ERR parameter. BLOCK_ERR is actually a bit string which provides a means to show multiple status or error conditions. A status message identifying the fault can be viewed by accessing the parameter. Table 10.5 shows the bit mapping of the BLOCK_ERR parameter.

Background Diagnostics Execution, BLOCK_TEST Parameter

To verify that block and background diagnostics are executing in a particular block:

View the BLOCK_TEST parameter of the block.

- If the first element of the parameter (BLOCK_TEST =) is incrementing, the block is executing and the diagnostics are active.
- If the first element value is not increasing, the block is not executing.

Table 10.5 BLOCK_ERR Parameter Bit Mapping (1 of 2)

BLOCK_ ERR Bit	Value or Message*	Description
0	Not used	Least Significant Bit (LSB)
1	Block configuration error	Invalid parameter value in block. See Clearing Block configuration Errors.
2	Not used	

Table 10.5 BLOCK_ERR Parameter Bit Mapping (2 of 2)

BLOCK_ ERR Bit	Value or Message*	Description
3	Simulate parameter active	The SIMULATE parameter is being used as the input to the AO block. This occurs if the simulate jumper is set to Y on the electronics board, and the ENABLE_DISABLE field of the SIMULATE parameter is set to 2. See Sub-section 10.8 also.
4	Not used	
5	Not used	
6	Not used	
7	Input failure/process variable has BAD status	Internal failure
8	Not used	
9	Memory failure	Block database (DB) error or ROM failure (resource block only)
10	Lost static data	Block Non-Volatile (NV) memory failure Stack NV memory failure Link or Trend objects NV memory failure
11	Lost NV data	EEPROM write to block DB failed EEPROM write to Stack DB failed (Resource block only) EEPROM write to Link or Trend DB failed (Resource block only)
12	Read-back check failed (Checksum error)	Communication failure to serial EEPROM (Resource block only)
13	Not used	
14	Not used	
15	Out-Of-Service	Out-Of-Service — The block's actual mode is OOS Most Significant Bit (MSB)

* Depending on the fieldbus interface application, device operating status and parameter values may appear as text messages. The text in the table is typical of values or messages seen when using the NI-FBUS Configurator.

ERROR_DETAIL Parameter

ERROR_DETAIL parameter in the resource block contains data that describes the cause of any device-critical error. This category of error will cause the resource block to

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remain in OOS actual mode regardless of its target mode. This in turn causes all other blocks to remain in OOS actual mode.

ERROR_DETAIL is an array of three unsigned integers, each 16 bits in size. The three sub-elements are generally defined as follows:

1. Error Type
2. Location
3. Sub-type

ERROR_DETAIL Enumeration

Table 10.6 lists the enumerated values for the error type element only. The location and sub-type elements have no significant meaning for users.

Table 10.6 ERROR_DETAIL Parameter Enumeration

ERROR_DETAIL	Message
0	No error
1	Control board ROM checksum
2	HC16 boot ROM checksum
3	HC16 application ROM checksum
4	Interprocessor error (startup)
5	Interprocessor error (operation)
6	EEPROM corrupt (background diagnostics)
7	EEPROM driver error
8	EEPROM - fieldbus write
9	Sensor error
10	Internal software error
11	Other

Using ERROR_DETAIL for Troubleshooting

If a critical error occurs in the resource block, the user should read and record the ERROR_DETAIL value. Then reset the device (write RESTART parameter Processor). Wait 30 seconds after reset and read ERROR_DETAIL again to check if error cleared.

10.5 Block Configuration Errors

Configuration Errors

Block configuration errors prevent a device block from leaving OOS mode. The BLOCK_ERR parameter (bit 1) shows whether a block configuration error is present. Table 10.7 summarizes the conditions that may be the result of block configuration errors, which in turn cause a device fault. Follow the recommended actions to correct these errors.

Table 10.7 Summary of Configuration Errors (1 of 2)

Problem/Fault	Probable Cause	Recommended Action
Name of parameters are not visible	Missing or incorrect version of device description file on host computer.	**1.** Check path to device description. **2.** Load correct version of DD.
Unable to write successfully to MODE_BLK of any block.	Mode not supported in TARGET and/or PERMITTED modes for the given block.	• Verify that the mode being written is supported by the block. • If writing TARGET mode only, then the desired mode must already be set in the PERMITTED field. • If writing the whole MODE_BLK record, then the mode set in TARGET must also be set in the PERMITTED field. Other modes may also be set in the PERMITTED field, but target mode must be set.
Unable to write to a parameter	**1.** Parameter is read-only. **2.** Sub-index of the parameter is read-only. Some parameters have fields that are not writable individually (such as MODE_BLK.ACTUAL). **3.** Write-locking is active. Resource block parameter WRITE_LOCK value is 2. **4.** Corresponding block is in the wrong mode. Some parameters can only be written to in OOS mode only, or in OOS or manual modes. **5.** Data written to the parameter is out of the valid range for that parameter. **6.** Subindex used is invalid for that parameter	**1.** None **2.** None **3.** Remove write protect jumper (see Subsection 6.5) **4.** Write valid mode to MODE_BLK parameter of block (OOS or MAN modes). See Mode Restricted Writes to Parameters in Sub-sections 8.6 and 8.7. **5.** Write valid range values to parameter. **6.** Enter valid subindex for parameter.
Unable to change resource block to auto mode	The second element of BLOCK_TEST is not zero.	Write all zeroes to the second element of the BLOCK_TEST parameter.

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Table 10.7 Summary of Configuration Errors (2 of 2)

Problem/Fault	Probable Cause	Recommended Action
Unable to change transducer block to auto mode	**1.** Resource block is in OOS mode	**1.** Write auto mode to MODE_BLK.TARGET of the resource block.
	2. The second element of BLOCK_TEST is non-zero.	**2.** Write all zeroes to the second element of the BLOCK_TEST parameter.
	3. A configuration error occurred in the block.	**3.** Find and correct any configurable parameter outside its valid range. See *Clearing Block Configuration Errors* in Sub-section 10.6.
Unable to change analog output block from OOS mode	**1.** The block has not been configured to execute. It is neither in the function block schedule in the system management information base, nor is it linked to another executing block via the next block to execute field in the block record (relative parameter index 0.	**1.** Build and download an execution schedule for the block including links to and from AO block with other function blocks.
	2. Resource block is in OOS mode.	**2.** Write auto mode to MODE_BLK of resource block.
	3. Block configuration error.	**3.** a. Check the parameters SHED_OPT and CHANNEL. All values must be non-zero. b. BLOCK_ERR for bit 1 set. If set, check all configurable parameters for possible invalid values. See *Clearing Block Configuration Errors* in Sub-section 10.6.
	4. The second element of BLOCK_TEST is not zero.	**4.** Write all zeroes to the second element of the BLOCK_TEST parameter.
AO block is in the correct mode but does not seem to be operating	**1.** Simulation active.	**1.** Disable simulation. See Sub-section 10.8 for procedure.
	2. The block has not been configured to execute. It is neither in the function block schedule in the system management information base, nor is it linked to another executing block via the next block to execute field in the block record (relative parameter index 0).	**2.** Build and download an execution schedule for the block including links to and from AO block with other function blocks.
	3. The second element of BLOCK_TEST is not zero.	**3.** Write all zeroes to the second element of the BLOCK_TEST parameter.

10.6 Clearing Block Configuration Errors

Clearing Block Configuration Errors

Table 10.8 and Table 10.9 list the parameters in the AO and PID blocks which can cause the status bit of block configuration error to be set in their respective BLOCK_ERR parameters. The tables also provide the initial values and the valid range for the parameters.

NOTE: Block configuration errors can only be cleared if the function block is being executed (running). One way of determining block execution is by doing a series of two or three reads of the BLOCK_TEST parameter and confirming that the first byte of the parameter is incrementing. This will work if the execute rate is fast relative to the speed of reading BLOCK_TEST. A very slowly executing block may not *appear* to execute because block parameters are updated only when the block executes.

Table 10.8 AO Block Parameters

Parameter	Initial Value	Valid Range	Corrective Action
ALERT_KEY	0	non-zero	Initial value is a configuration error. Set value to non-zero number.
SIMULATE	1 (disabled)	1-2 (disabled -enabled)	Set value in valid range.
XD_SCALE	0 to 100	EU_100 > EU_0, UNITS_INDEX matches output of transducer block	Set values to valid range(s).
CHANNEL	0	1-2	Initial value is a configuration error. Set value to valid range.
SP_RATE_DN SP_RATE_UP	+INF	0-15	Set value to valid range.
SP_HI_LIM,	100	0-100	Set value to valid range.
SP_LO_LIM	0	0-100	Set value to valid range.
SHED_OPT	0	1-8 (see Shed Options in the FF specs.)	*Initial value is a configuration error.* Set value in valid range.

Table 10.9 PID Function Block Parameters (1 of 2)

Parameter	Initial Value	Valid Range	Corrective Action
BYPASS	0	1:OFF, 2:ON	Initial value is a configuration error. Set value in valid range.
SHED_OPT	0	1-8 (see Shed Options in the FF specs.)	Initial value is a configuration error. Set value in valid range.
HI_HI_LIM HI_LIM	+INF +INF	PV_SCALE, +INF	Values must be set in rank order (e.g. LO_LIM > LO_LO_LIM but < HI_LIM etc.)

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Table 10.9 PID Function Block Parameters (2 of 2)

Parameter	Initial Value	Valid Range	Corrective Action
LO_LIM LO_LO_LIM	-INF -INF	PV_SCALE, -INF	Values must be set in rank order.
OUT_HI_LIM OUT_LO_LIM	100 0	OUT_SCALE +/- 10%	Verify that OUT_HI_LIM > OUT_LO_LIM.
SP_HI_LIM SP_LO_LIM	100 0	PV_SCALE +/- 10%	Verify that SP_HI_LIM > SP_LO_LIM.

10.7 Additional Troubleshooting

As a general rule, follow the suggestions for corrective action for suspected problems described this document. If a problem is still present, perform step 1 below. If the problem still persists, perform step 2 and so on.

1. In the resource block set the RESTART parameter to ‘Processor.’
2. Cycle power to the Logix 1400 digital positioner
3. Re-start fieldbus driver software on the host computer with the Logix 1400 digital positioner un-powered, then power-up the Logix 1400 digital positioner.
4. Call Flowserve’s Valtek Control Product Technical Assistance. (See *Technical Assistance* on page x.)

10.8 Simulation Mode

Simulation Mode Jumper

A simulation mode is available in the positioner, which is used to aid in system debug if the process is not running. When simulation mode is enabled, the SIMULATE parameter in the AO block provides a user-selected value as the readback input to the AO block.

Setting Simulation Jumper

A hardware jumper on the positioner board is set to enable or disable the SIMULATE parameter. See Figure 10.1 for jumper location. Table 10.10 shows how to set the simulation jumper on the transducer board.

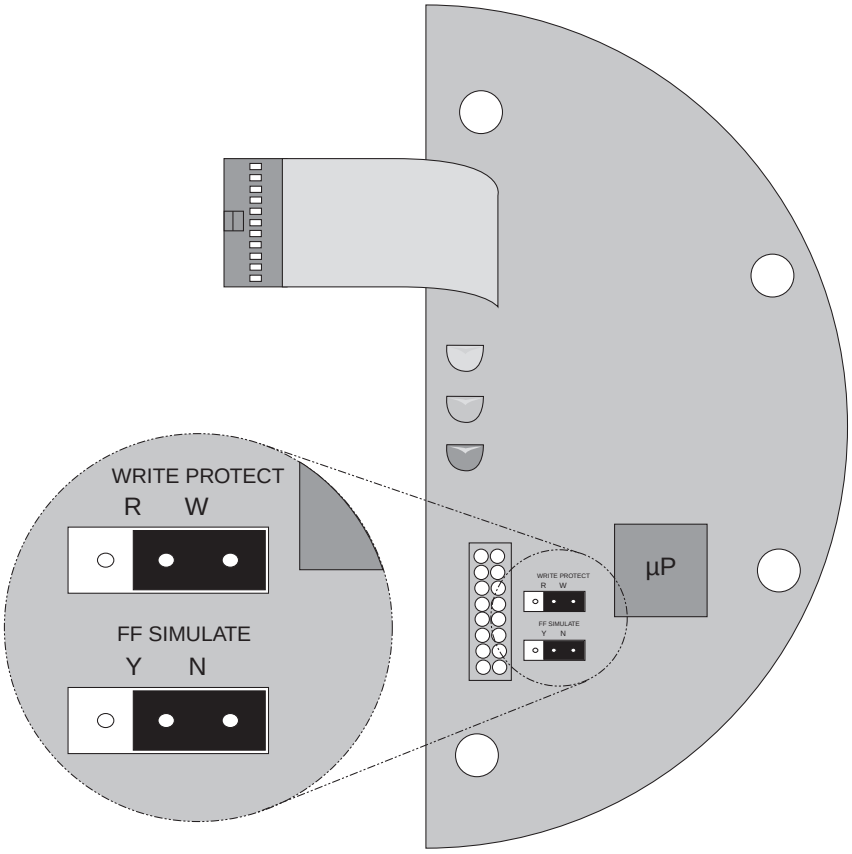
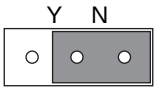
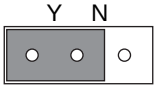


Figure 10.1 Simulation Jumper Location on Controller Board

Table 10.10 Setting the Simulation Jumper

To	Set the Jumper to:
Disable the SIMULATE parameter. (Set transmitter for normal operation.)	N position on the transducer board. 
Enable the SIMULATE parameter. (For testing or debugging purposes)	Y position on the transducer board. 

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Enabling Simulation Mode

The SIMULATE parameter is enabled by setting the hardware simulation jumper to the Y position.

Additionally, AO block SIMULATE parameter must be set to the following values:

SIMULATE

STATUS =	*Good::[alarm status]:constant* (suggested setting)
SIMULATE_VALUE =	(supplied by user) used as the readback input to the AO block.
ENABLE_DISABLE =	Active enabled

Simulation Mode Truth Table

The truth table in Table 10.11 shows the states of the simulation jumper and SIMULATE parameter to activate the simulation mode.

Table 10.11 Simulation Mode Truth Table

When the Simulation Jumper on Transducer board is set to:	... and the SIMULATE Enable_Disable is set to:	
	1 (Disabled)	2 (Active)
N Position	Simulation Disabled	Simulation Disabled
Y Position	Simulation Disabled	Simulation Active

Simulation Mode

A simulation mode is available in the AO function block to set the value and status of READBACK when it is necessary to override the transducer value or status.

The SIMULATE parameter contains the following elements:

- SIMULATE_VALUE - Contains the value that is copied to the READBACK parameter.
- SIMULATE_STATUS - Contains the status that is copied to the READBACK parameter.
- TRANSDUCER_VALUE - Contains the value read from the transducer position source.
- TRANSDUCER_STATUS - Contains the status read from the transducer position source.
- ENABLE_DISABLE - Enables simulation of the SIMULATE_VALUE and SIMULATE_STATUS when selected.

Enabling Simulation

Before the ENABLE_DISABLE in the SIMULATE parameter may be selected, the hardware simulation must be enabled for the device.

To enable simulation in the device, set the SIMULATE jumper to the "Y" position, select RESTART_PROCESSOR in the Resource block RESTART parameter.

To ensure that simulate is permitted in the device, go to the Resource Block and read the BLOCK_ERR parameter. It should indicate Simulation Enabled.

Simulating the Transducer

To simulate the READBACK parameter, set the SIMULATE parameter as follows:

1. Set ENABLE_DISABLE to ACTIVE and write the parameter.
2. Set SIMULATE_VALUE and SIMULATE_STATUS as desired and write the parameter.
3. Read the READBACK parameter. This should reflect the value and status which was set in the SIMULATE parameter.

NOTE: The TRANSDUCER_VALUE and TRANSDUCER_STATUS will continue to be updated by the transducer source as described in the next section.

Transducer Position Source Selection

The source of the TRANSDUCER_VALUE and TRANSDUCER_STATUS in the SIMULATE parameter is determined by the FEATURE_SEL parameter in the Resource Block. If FEATURE_SEL OUT_READBACK not selected (default) then the transducer source will be the AO OUT parameter. If FEATURE_SEL OUT_READBACK is selected then the transducer source will be the FINAL_POSITION_VALUE from the Transducer Block.

Because the FINAL_POSITION_VALUE in Logix 1400 transducer block reflects the actual actuator position, the OUT_READBACK feature should be always be selected during normal operation.

AO Block Mode

To connect the AO block input to the output, the AO block must be in AUTO mode.

10.9 Logix 1400 Digital Positioner Troubleshooting Guide

Table 10.12 Symptom Chart (1 of 3)

Failure or Problem	Probable Cause(s)	Refer to Section(s)
Mounting and Installation		
LED won't blink	**1.** Input polarity may be reversed. **2.** Termination may be incorrect. **3.** Calibration is in process.	**1.** See *Electrical Wiring Summary* on page 22.
Valve moves in wrong direction with no change in input signal	**1.** May be tubed for wrong air action. **2.** Spool stuck.	**1.** See *Air Action* on page 26. **2.** See *Spool Valve* on page 123. *Logix 1400 Digital Positioner* IOM.
Unit does not respond to fieldbus command.	**1.** Unit is not configured correctly. **2.** Error occurred during calibration.	**1.** See *Theory of Operation* on page 3. **2.** See *Calibration* on page 99.
Calibration		
Red LED blinks after a Re-Cal operation. Valve stays in fully open or closed position.	**1.** Configured for linear on a rotary mounting. **2.** Feedback linkage out of range.	**1.** See *Re-Cal button* on page 101.
Yellow LED blinks after a Re-Cal, or calibration operation.	**1.** Valve didn't fully stroke during calibration (low or no air supply). **2.** Stuck Spool.	**1.** See *Re-Cal button* on page 101. **2.** See *Spool Valve* on page 123. *Logix 1400 Digital Positioner* IOM.
On a rotary, valve has a dead band at the fully open or closed position.	**1.** Mechanical travel is not centered within the electrical measurement range (position sensor out of range).	**1.** See *Linear vs. Rotary* on page 26.

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Table 10.12 Symptom Chart (2 of 3)

Failure or Problem	Probable Cause(s)	Refer to Section(s)
Control and Tuning		
Valve won't saturate at closed position.	**1.** May need to enable MPC **2.** Calibration required.	**1.** See *MPC* on page 82.
Valve won't go below or above a certain limit.	**1.** Soft limits are not enabled **2.** MPC is not enabled	**1.** See *Advanced Features* on page 123.
Sticking or hunting operation of the positioner.	**1.** Contamination of spool valve assembly **2.** P+I setting incorrect	**1.** See *Air Supply Requirements* on page 15. See *Spool Valve* on page 123. **2.** See *Setting P+I Parameters* on page 121.
Large initial deviation; only present on initial power-up.	**1.** Inner loop offset not correct.	**1.** See *Setting P+I Parameters* on page 121.
Stem position movement is not linear with command.	**1.** Custom characterization is not enabled	**1.** See *Custom Characterization* on page 124.
Fieldbus Communication		
Logix 1400 digital positioner will not communicate with fieldbus.	**1.** Power problem. **2.** FB card connection.	**1.** See *Wiring the Logix 1400 Digital Positioner to a Fieldbus Network* on page 19. **2.** Verify FB protocol being used.
Configurator displays 'Unknown' after it connects.	**1.** DD has not been loaded in the configurator correctly.	**1.** Reload DD making sure Valtek products are listed.
Erratic communications occur.	**1.** Maximum cable length or impedance exceeded **2.** Card not receiving enough power. (Laptop batteries possibly low) **3.** Interference with I.S. barrier	**1.** See *Wiring the Logix 1400 Digital Positioner to a Fieldbus Network* on page 19.

Table 10.12 Symptom Chart (3 of 3)

Failure or Problem	Probable Cause(s)	Refer to Section(s)
Alarms		
Temperature alarm occurs.	**1.** Ambient temperature has exceeded electronics ratings	**1.** See *Temperature Alarm* on page 81.
Hall sensor alarm occurs.	**1.** Hall connector may have bad connection **2.** Sensor may be damaged	**1.** See *Hall sensor Alarm* on page 81.
Modulator current alarm occurs.	**1.** Modulator minimum pressure may be too low. **2.** Clogged orifice **3.** Bad cable connection	**1.** See *Modulator current Alarm* on page 81.
EEPROM checksum alarm occurs.	**1.** Error when reading non-volatile memory storage	**1.** See *EEPROM checksum Alarm* on page 81.
Multiple internal flags occur.	**1.** Bad micro-controller on main PCB assembly.	
LEDs		
LED alternates between Green and Red in normal operation.	**1.** Modulator coil current may be too high. **2.** Supply pressure may be close to minimum of 30 psig.	**1.** See *Modulator current Alarm* on page 81. **2.** See *Loss of Pressure* on page 82.
No LED blinks during calibration	**1.** This occurs during normal operation.	
Yellow LED is blinking, but valve position is fine.	**1.** User defined limit may have been reached. Check alarm screen.	**1.** See *Internal Positioner Alerts* on page 82.
Red LED is blinking on advanced model, even though positioner has pressure.	**1.** Pressure below 30 psi. **2.** Check internal alarms.	**1.** See *Loss of Pressure* on page 82.
Advanced Features		
Will not display pressure readings.	**1.** Is configuration set to advanced?	**1.** See *Standard vs. Advanced Diagnostics* on page 123.
MPC will not function.	**1.** Is lower soft limit >= 0%. **2.** Set-point should be 1 percent hysteresis around MPC.	**1.** See *MPC* on page 82.

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10.10 Internal Positioner Issues

Positioner Inner loop Control and Tuning

Setting P+I Parameters: Using the configurator, the user can set individual tuning parameters. A few key points are mentioned below.

GAIN_UPPER, GAIN_LOWER and GAIN_MULT: These three parameters are related by the following formula.

Proportional gain = maximum gain - | deviation | x gain multiplier
If proportional gain < minimum gain, then proportional gain = minimum gain

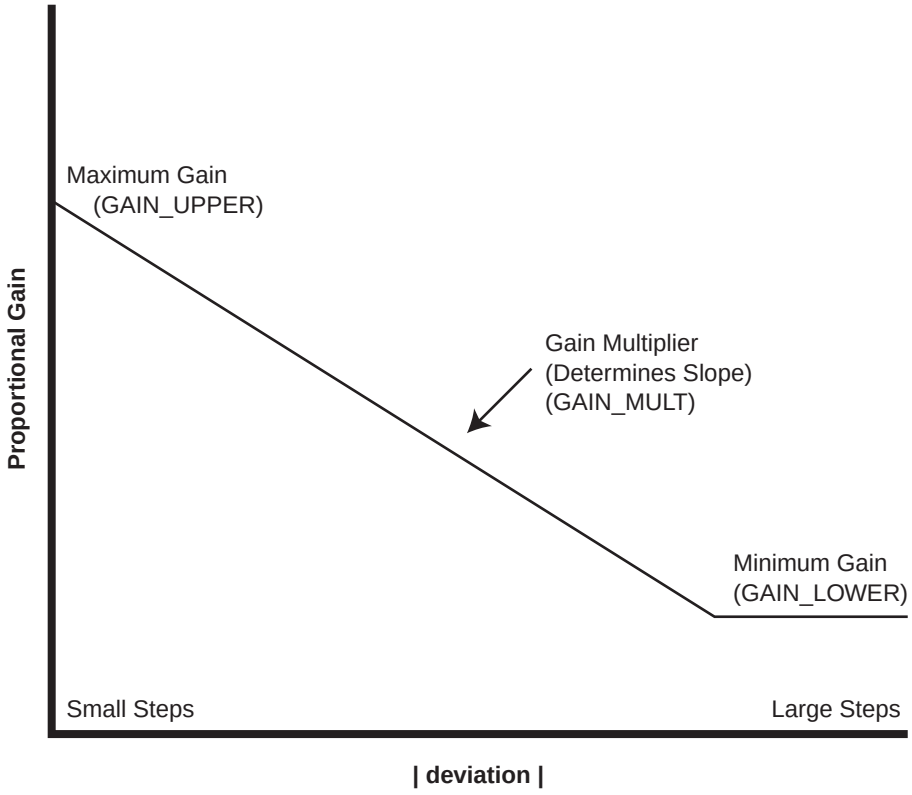

Figure 10.2 Gain Effect Diagram

This algorithm allows for quicker response to smaller steps yet stable control for large steps. (Refer to Figure 10.2.) Setting the gain multiplier to zero and max gain = min gain results in a typical fixed proportional gain.

The higher the gain multiplier, the larger the required deviation before the gain increases. Default values upon initiating a reset to the factory defaults are maximum gain= 2.0, minimum gain = 1.0, and gain multiplier = 0.05. These values will allow stable control on all Valtek control product actuator sizes.

Integral Gain (IGAIN): The integral gain is primarily for deviations due to temperature drift within the inner loop spool control. The factory default value is 10. Although higher numbers can speed the time it takes to reach zero deviation, it can add overshoot if too large. It is recommended that maximum and minimum gains be adjusted while leaving Integral Gain fixed at 10. Integration is disabled below a stem position of 3 percent and above a stem position of 97 percent. This is to prevent integration windup from calibra-

tion shifts due to lower pressure or a damaged seat which may prevent fully closing the valve.

Integration Summer: The integral summer within the Logix 1400 digital positioner is clamped at +20.00 percent and –20.00 percent. If the integration summer is fixed at +20% or –20%, it usually indicates a control problem. Some reasons for a clamped integration summer are listed below:

- Stroke calibration incorrect
- Any failure which prevents stem position movement: stuck spool, handwheel override, low pressure.
- Incorrect inner loop offset
- Loss of air supply on a fail in place actuator

Writing a zero to integral gain will clear the integral summer. The integral gain can then be returned to its original value.

Inner Loop Offset (IL_OFFSET): Referring to Figure 1.3 on page 3, three control numbers are summed to drive the inner loop spool position control: proportional gain, integral summer, and inner loop offset. Inner loop offset is the parameter that holds the spool in the null or balance position with a control deviation of zero. This value is written by the positioner during stroke calibration and is a function of the mechanical and electrical spool sensing tolerances. However, if replacing the Driver Module Assembly is necessary, or the software reset has been performed, it may be necessary to adjust this value. The method below should be used to adjust inner-loop offset. Or simply perform a new stroke calibration.

From the fieldbus configurator,

- Send a 50 percent command.
- Set integral to zero.
- Locate the DAC_PERCENT
- Write this percentage value to IL_OFFSET.
- Write original value to Integral

Table 10.13 Logix 1400 Digital Positioner Factory Tuning Sets (1 of 2)

Brand	Tuning Set	GAIN_ LOWER	GAIN_ UPPER	GAIN_ MULT	Igain	Comparable Actuator
Valtek	VFactory_A	1.00	2.00	0.05	10.0	25 sq. in.
	VFactory_B	1.00	2.50	0.05	10.0	50 sq. in.
	VFactory_C	2.00	3.00	0.05	10.0	100 sq. in.
	VFactory_D	4.00	5.00	0.05	10.0	200 sq. in.
	VFactory_E	4.00	7.00	0.05	10.0	300 sq. in.
	Trooper 48	0.40	0.50	0.05	25.0	31 sq. in.
	Trooper 49	3.00	4.00	0.05	10.0	77.5 sq. in.
Kammer	Trooper 48	0.40	0.50	0.05	25.0	31 sq. in.
	Trooper 49	3.00	4.00	0.05	10.0	77.5 sq. in.

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Table 10.13 Logix 1400 Digital Positioner Factory Tuning Sets (2 of 2)

Brand	Tuning Set	GAIN_ LOWER	GAIN_ UPPER	GAIN_ MULT	lgain	Comparable Actuator
Automax	R1	0.30	0.50	0.05	10.0	3 to 5 sq. in.
	R2	1.00	1.50	0.05	10.0	9 to 12 sq. in.
	R3	1.30	2.00	0.05	10.0	16 to 19 sq. in.
	R4	2.00	2.50	0.05	10.0	27 to 37 sq. in.
	R5	2.50	3.60	0.05	10.0	48 to 75 sq. in.
	R6	4.00	5.00	0.05	10.0	109 sq. in.

Spool Valve

The spool valve is a four-way directional valve with precision features to provide optimal control and low air consumption. To help prevent spool valve malfunction, the positioner supply air must conform to ISA Standard S7.3 (a dew point at least 18 degrees below ambient temperature, particle size below 1 microns, oil content not to exceed 1 part per million). Flowserve's standard coalescing filter is highly recommended to help meet these requirements.

Small particles, oil that has varnished, corrosion, ice, burrs, and extreme wear could cause the spool valve to act abnormally. If the spool valve is suspected of sticking, it can be inspected by performing the following.

1. Make sure the valve is bypassed or in a safe condition.
2. Disconnect the power and air supply to the unit.
3. Remove the spool valve cover by removing the screw and sliding the cover assembly backwards until the tab is clear of the slot.
4. Inspect the coalescing filter element in the spool valve cover for signs of oil, water and debris that may have come from the air supply. A clean filter is white.
5. Remove the two phillips-head screws holding the spool valve to the housing. Inspect the free movement of the spool by carefully sliding the block up and down on the spool about 0.25 inches. The block should slide on the spool with no resistance. Carefully remove the block, ensuring it is removed concentric with the spool.
6. Inspect the block and spool for oil, water, debris and wear. If oil, water and/or debris are found, the spool and block can be cleaned with a non-residue cleaner, lint-free cloth and soft bristle brush. If wear is found, replace the driver module assembly per the IOM manual.
7. Before re-assembly, verify that the three O-rings are in the counter-bores on the machined platform where the spool valve block is to be placed.
8. Carefully slide the block over the spool, using the machined surface of the housing base as a register. Slide the block toward the driver module until the two retaining holes line up with the threaded holes in the base. If resistance is still encountered, re-clean both parts or replace the driver module assembly. Refer to the IOM manual for spare part kit numbers.

Refer to the instructions in the *Logix Series 1400 Digital Positioner* IOM under Driver Module Assembly for further instructions.

Advanced Features

Standard vs. Advanced Diagnostics:
Question: What is the difference between a model with standard diagnostics and a model with Advanced diagnostics?

Answer: The model with advanced diagnostics adds top, bottom, and supply pressure sensors. This allows for the collection of data for more diagnostic calculations, such as loss of pressure, friction, advanced signatures, and troubleshooting.

Question: Can I upgrade from a standard to an advanced model?

Answer: Yes. Advanced collector board assembly can be purchased (see IOM). Simply replace the standard collector board with the advanced collector board. All connectors on the collector board are keyed and unique for easy cable re-connection. Using FB configurator, perform an actuator pressure calibration.

Temperature and Pressure Units: The desired temperature and pressure units can be set during configuration. Once set, all readings will be displayed in the desired units. Parameters TEMP_UNITS and PRESS_UNITS in the transducer block.

Stroke Length: Stroke length is used by the travel accumulator (TRAVEL_ENG). When the stroke length and units are set, the length is used to determine the total travel accumulated. The travel accumulator will have the units associated with stroke. Parameters STROKE_ENG and TRAVEL_UNITS in the transducer block.

Example: Stroke length is set to 4 inches. If the valve is moved from 0 percent to 100 percent, 4 inches will be added to the travel accumulator. The travel accumulator units will be inches. If stroke length is 90 degrees for a rotary, the travel accumulator will now have units of degree. A 0 percent to 100 percent stroke will add 90 to the travel accumulator.

NOTE: Stroke length is for information only.

Custom Characterization: Custom characterization can be thought of as a soft cam. The user can choose between an equal percentage, quick opening, or custom user-defined characterization curve using 21-points. The control will linearly interpolate between points. Points do not have to be equally spaced in order to allow more definition at critical curve areas.

The Logix 1400 digital positioner has two modes: linear and characterization. Linear is a straight 1:1 mapping of command to control command. It does not use the 21-point curve definition. When custom characterization is *disabled*, the positioner is automatically in linear mode. If custom characterization is *enabled*, the Logix 1400 digital positioner uses one of the 21-point user defined curves.

Question: Does a default custom characterization curve exist?

Answer: Yes. The Logix 1400 digital positioner comes with a factory-default equal percent (and quick opening) curve in Figure 10.3.

NOTE: The quick opening curve is the inverse of the equal percent curve.

Table 10.14 Logix 1400 Digital Positioner Characteristic Curves (1 of 2)

FINAL_VALUE (%FS)	CMD_USED (%FS)		
	Quick Open	Equal Percent	Linear
0	0.0	0.00	0
5	18.8	1.00	5
10	37.6	2.00	10
15	56.4	3.00	15
20	74.0	4.00	20
25	84.3	5.24	25

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Table 10.14 Logix 1400 Digital Positioner Characteristic Curves (2 of 2)

FINAL_VALUE (%FS)	CMD_USED (%FS)		
	Quick Open	Equal Percent	Linear
30	90.0	6.47	30
35	92.0	8.02	35
40	93.4	9.57	40
45	94.2	11.86	45
50	94.8	14.15	50
55	95.5	17.54	55
60	96.0	20.93	60
65	96.5	25.94	65
70	97.0	30.95	70
75	97.5	38.36	75
80	98.0	45.77	80
85	98.5	55.66	85
90	99.0	67.68	90
95	99.5	82.31	95
100	100.0	100.0	100

NOTE: Custom characterization points can only be entered with the FB configurator.

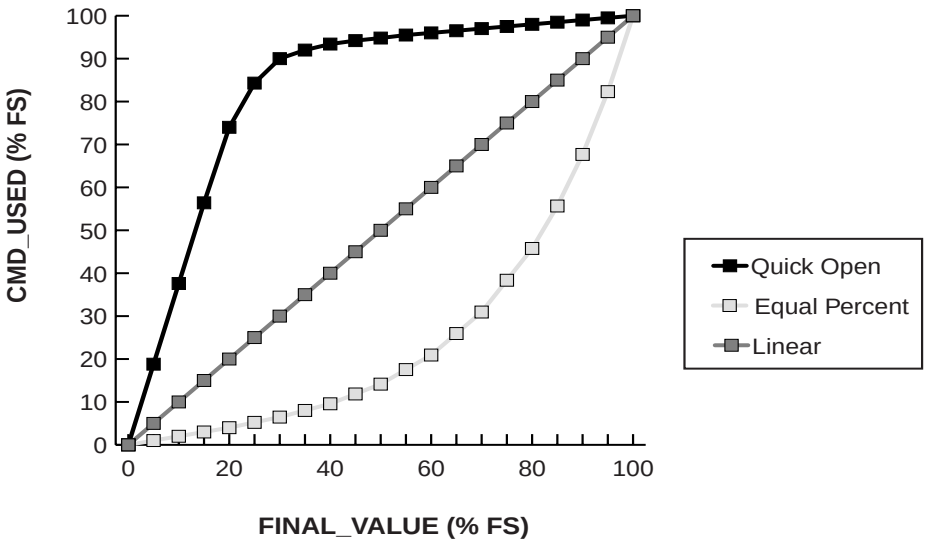

Figure 10.3 Logix 1400 Digital Positioner Characteristic Curves

10.11 Stroke Characterization

In addition to three pre-defined and embedded characterization curves, the Logix 1400 positioner has a 21-point custom stroke characterization feature. This allows the user to define a unique set of operating parameters customizable to his process conditions.

Table 10.15 Transducer Block Characterization Parameters (1 of 2)

Parameter	Description	Value — Meaning	Comments
MODE_BLK	The operating mode of the transducer block	Permitted Modes: Auto - Auto (target mode) OOS - Out of Service	The transducer block must be out-of-service before the user can edit or change characterization.
CONTROL_FLAGS	Byte values which select positioner operation features	1 Quick Opening Curve*	Loads factory defined QO curve as custom curve.
		2 Equal Percent Curve	Loads factory defined equal percent curve as custom curve.
		3 Actuator Type	
		4 Positioner Model	
		5 Actuator Style	
		6 Custom Characterization Active	Activates custom curve. If Off, response is Linear.
		7 Fail Position	
		8 Air Action	
CURVEX	Numeric X value array for custom point. (1x21 array points)	X-axis value for custom stroke characterization point. Range -10 to 110	Pair each X-value with corresponding Y-value to define the desired point. Values must be in ascending (or equal) order.

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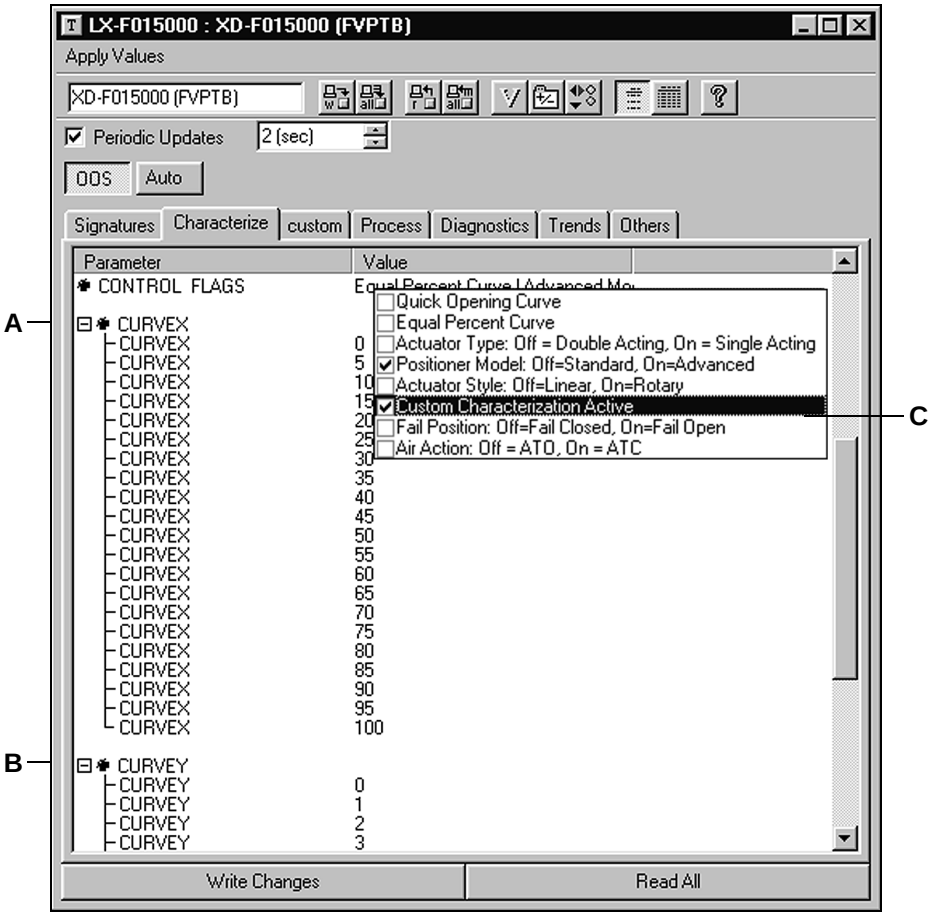
Table 10.15 Transducer Block Characterization Parameters (2 of 2)

Parameter	Description	Value — Meaning	Comments
CURVEY	Numeric Y value array for custom point. (1x21 array points)	Y-axis value for custom stroke characterization point. Range -10 to 110	

* Must not be selected if a custom curve is to be created or edited.

10.12 Characterization Procedure

The following procedure outlines the basic way setting up a custom stroke characterization takes place.



A. *X-axis variables (21)* ***B.*** *Y-axis variables (21)* ***C.*** *Control Flags window*

Steps:

1. Verify the process is in a safe condition and that the valve may be taken out of service.

2. Put the Transducer block MODE_BLK OOS
3. Make sure that 'Quick Opening Curve', 'Equal Percent Curve', nor ' Custom Characterization Active' are selected in CONTROL_FLAGS.
4. Enter the values for CURVEX and CURVEY to define the desired response. Care must be taken to assure that each CURVEX value has the correct corresponding CURVEY value. The user may choose any number in the range to define the curve. The 21 CURVEX points do not need to be evenly spaced, if so desired. However, the CURVEX values must be in ascending (or equal) order. The CURVEY points may be any value in the range, ascending or descending. The response is a linear interpolation, or straight-line, response between points. All 21-points must be defined. (i.e. If only 5 point sets were needed to define the desired operation, the remaining 16 points would need to be set to 110.).
5. Write the changes to the Logix 1400 digital positioner.
6. Activate the custom curve by selecting 'Custom Characterization Active' in CONTROL_FLAGS. (NOTE: Make sure that neither 'Quick Opening Curve' nor 'Equal Percent Curve' has been selected.)
7. Write the changes to the Logix 1400 digital positioner.
8. Verify the proper operation of the stroke response by incrementally writing values to FINAL_VALUE. (The Resource Block must also be OOS first.) CMD_USED, FINAL_POSITION_VALUE, and the valve response should track the desired curve.
9. Return the valve to service by returning both MODE_BLKs back to Auto.

Characterization Retention

Once a custom curve has been loaded into the Logix 1400 digital positioner's memory it is retained in the EPROM until it is either edited or replaced. Turning 'Custom Characterization Active' on or off now selects between a linear response (Off), or the new custom curve (On). If either of the other two factory curves is selected it will overwrite the custom curve in RAM, only. The custom curve will automatically be activated again when the factory curve is deselected.

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10.13 Initiating a Valve Signature

A feature of the Logix 1400 positioner is the ability to capture and store a valve diagnostic signature in the positioner's volatile RAM. A signature is the collected data response of the valve to a pre-defined set of operating conditions. This stored data can later be uploaded to the host system for analysis of potential problems. By comparing a baseline signature, when the valve is new, to subsequent signatures at later times, a rate of change can be tracked which can help predict possible faults in the valve before they happen. This is called 'predictive maintenance'. It is important to note that the purpose of the positioner is to act as the data acquisition device for the signature. Analysis of the data is not done on the device, but in the supervisory system.

System Preparation

WARNING: By definition, the collection of the signature requires the unmanaged operation of the positioner. Therefore, the process must be in a safe operating mode where unexpected movement of the valve will not cause a hazardous condition.

Before a valve signature can be run, the Transducer Block must be out of service (OOS).

Table 10.16 Transducer Block Signature Parameters (1 of 2)

Parameter	Description	Value-Meaning	Comments
MODE_BLK	The operating mode of the transducer block	Permitted Modes: Auto - Auto (target mode) OOS - Out of Service	The transducer block must be in the OOS mode to perform a signature
SIG_FLAGS	Byte values which select which signature options are used	0 - VALVE INIT Initializes valve for signature capture. Read-only 1 - STEP_RAMP Selects which type of signature is desired. Select for ramp signature. 2 - SIG_COMPLETE Status byte set when the signature has been completed, Read-only 4 - PRESS_MEAS Selects if actuator pressure readings are desired as part of the signature. Select for readings 5 - BEGIN_SIG Set to initiate the signature routine.	Select the desired signature options and then make sure the signature parameters are set to the desired operation before beginning the signature.
SIG_START	Beginning position point (%) for signature	-10% to 110% position range	Set higher than the stop position for a valve closing signature.
SIG_STOP	Ending position point (%) for signature	-10% to 110% position range	Set lower than the starting position for a closing signature

Table 10.16 Transducer Block Signature Parameters (2 of 2)

Parameter	Description	Value-Meaning	Comments
RAMP_RATE*	Desired rate (% per Minute) for ramp	%/Min. Minimum value is 1.0	Typically this is set to 100. Very long times could result in completely filling the 10K RAM buffer. Can only be set when STEP_RAMP in SIG_FLAGS has been selected.
SAMPLE_TIME	Data acquisition time between samples	Seconds. Range 0.1 to 2.55. Set to a valid value before running signature. Typically 0.1	Determines the number of data points stored in the signature.
STEP_TIME*	Delay time after step	Seconds. Range 0-650.0 Typically set to 0.1	Allows settling time to capture valve response to the step. Can only be set when STEP_RAMP in SIG_FLAGS is **not** selected.
SIG_INDEX	Pointer used for data transfer	Write the desired packet value.	Writing a value between 1 and the max number shown in SIG_COUNTER moves that packet of data into the SIG_DATA array for retrieval.
SIG_COUNTER	Indicates number of data points collected	Increments by 1 as each data packet is collected	
SIG_DATA	Array for the storage and transfer of signature data		Order of data is: Command (%) Position (%) Port 2 pressure Port 1 pressure
STROKE_TSTPSI	Supply pressure in PSI for stroke test	150 psi max.	
STROKE_OPENTIM	Stroking time during opening	Seconds	Determined during the last stroke calibration where the Step Time Test option was ran
STROKE_CLOSEDTIM	Stroking time during closing	Seconds	Determined during the last stroke calibration where the Step Time Test option was ran

* **Special Note**: Because of the internal Database size limit of 10K within the Fieldbus device, the values for RAMP_RATE or STEP_TIME may be recalculated to the most reasonable value to allow using the database. The new value will appear in the parameter after the desired one is written. This is done to prevent accidental overflow of the database.

It is still possible that the database may overflow, because of timing constraints. If this should happen, SIG_COMPLETE will not appear, but BEGIN_SIG will be turned off. BLOCK_TEST element 6 will be set to 10 (0x0a) as an error indication. Since this does not affect operation of the positioner itself, no actual error will be reported over Fieldbus.

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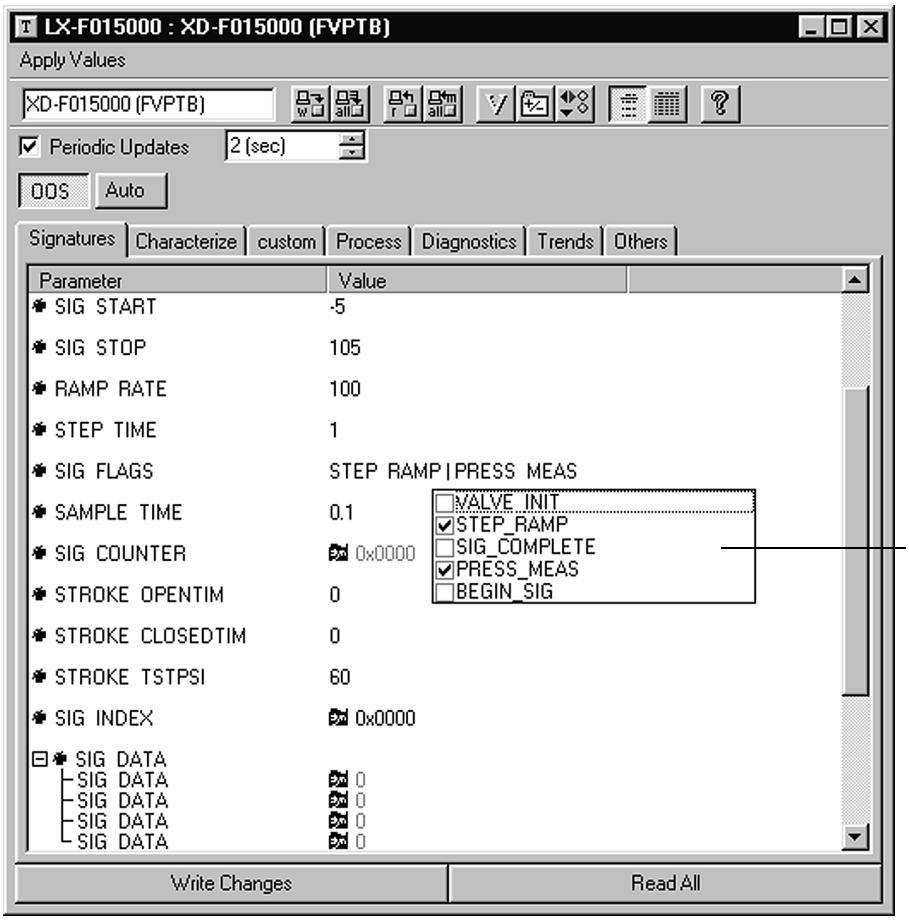
10.14 Signature Procedure

The following steps are an example of how to initiate a **ramp signature** capture.



A. *Signature Flags box*

1. Make sure the process is in a safe condition and notify the control room that the valve will temporarily be taken off-line.
2. Verify preparedness to proceed.
3. Put the Transducer block MODE_BLK OOS
4. Set SIG_START to desired value.
5. Set SIG_STOP to desired value.
6. Set SAMPLE_TIME to desired value. (Typically 0.1)
7. In SIG_FLAGS, select; STEP_RAMP, PRESS_MEAS.
8. Write values to the Logix 1400 digital positioner.
9. Set RAMP_RATE to desired value. (Typically 100)
10. Write value to the Logix 1400 digital positioner.
11. In SIG_FLAGS, select BEGIN_SIG.
12. Write value to the Logix 1400 digital positioner.

13. The valve will stroke to the beginning position, as defined by SIG_START ,and will begin ramping to the desired ending position, as defined by SIG_STOP. Notice that SIG_COUNTER will increment while this takes place. (Typically- approx. 670 data sets will be collected with the above settings and full stroke of the valve. Exact numbers will vary)
14. SIG_FLAGS indicates SIG COMPLETE.
15. Return the MODE_BLK to Auto
16. Notify control room the valve is back on-line.

The stored signature will remain in the Logix 1400 digital positioner volatile RAM until the either the unit is powered down, or another signature is taken which overwrites the previous one.

STEP SIGNATURE

If a step signature was desired, simply do not select STEP_RAMP in SIG_FLAGS, and then set the STEP_TIME prior to selecting BEGIN_SIG.

Collection of Stored Signature

The collection of the stored signature is accomplished by the host system. It is not part of the device. See host system programming.

A simple utility using National Instruments NIFBUS is available from Flowserve for retrieving a signature file. This file is stored in a text format that can be imported into other programs for plotting and analysis.

Contact Flowserve for more details.

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Section 11: Software Maintenance

11.1 Code Download

Code Download Utility

A code download may be recommended to upgrade the fieldbus firmware. A download utility program is used to perform the upgrade. A code download also updates other files necessary for proper operation; specifically, new versions of the Standard Dictionary and Device Description files are loaded on the host computer. These files are compatible with the new code.

A PC-based application is available to download new firmware into a Logix 1400 digital positioner. Refer to the documentation accompanying that application for instructions.

A code download can be performed on an active live network. Prepare the control loop by blocking in the final control device to a safe state. The positioner will be off-line for about 30 minutes. Save the present configuration before downloading. When the download is complete, the positioner will revert to its default settings.

The Effects of a Code Download on a Device

The effects on a device (as a result of the download) are that all configuration data in the device, with the exception of calibration data, is cleared. This includes:

- Device and block tags
- Block parameters
- The function block schedule
- Link object, trend object, and VCR configurations
- The network schedule

This requires the user to reconfigure the block tags and the control system, and then download the configuration (FBAP file) to the device and other device on the network.

The device ID may appear differently on the network, due to differences between the new and older software versions. The device may appear as a new device since the NI configuration system uses the device ID as the key identification variable for a device.

Appendix A: Sample Configuration Record

Sample Device Configuration

The following pages provide a printout example of the *Function Block Application* portion of a Logix 1400 digital positioner device configuration file. The printout was generated using the NI-FBUS Configurator application and shows function block parameters and values for a typical control loop. The printout is shown at the left side of the page. Comments and notes on the configuration are given on the left-hand side.

All parameters, including read-only parameters, are included for completeness.

Table 11.1 Logix 1400-011 : RS-011 (RB) (1 of 4)

Configuration File Data	Comments
(1) ST_REV = 0x0000	Device tag : Block tag name Block tagname (Resource block) (index) Parameter mnemonic = value
(2) TAG_DESC =	
(3) STRATEGY = 0x0000	
(4) ALERT_KEY = 0x00	
(5) MODE_BLK = TARGET = Auto ACTUAL = Auto PERMITTED = Auto | OOS NORMAL = Auto	
(6) BLOCK_ERR = 0x0000	
(7) RS_STATE = Online	

Table 11.1 Logix 1400-011 : RS-011 (RB) (2 of 4)

Configuration File Data	Comments
(8) TEST_RW = VALUE_1 = FALSE VALUE_2 = 0x00 VALUE_3 = 0x0000 VALUE_4 = 0x00000000 VALUE_5 = 0x00 VALUE_6 = 0x0000 VALUE_7 = 0x00000000 VALUE_8 = 0 VALUE_9 = (NULL) VALUE_10 = (NULL) VALUE_11 = 01/01/00 00:00:00 (MM/DD/YY HH:MM:SS) VALUE_12 = 01/01/84 00:00:00 (MM/DD/YY HH:MM:SS) VALUE_13 = 0:00:00:00 (DD:HH:MM:SS) VALUE_14 = 0x0000 VALUE_15 = 01/01/72 00:00:00 (MM/DD/YY HH:MM:SS)	
(9) DD_RESOURCE = (NULL)	
(10) MANUFAC_ID = 0x00464c53	
(11) DEV_TYPE = 0x0202	
(12) DEV_REV = 0x06	
(13) DD_REV = 0x01	
(14) GRANT_DENY = GRANT = 0x00 DENY = 0x00	
(15) HARD_TYPES = Scalar Input	
(16) RESTART = Run	
(17) FEATURES = Reports | Faultstate	
(18) FEATURE_SEL = 0x0000	
(19) CYCLE_TYPE = Scheduled	
(20) CYCLE_SEL = 0x0000	
(21) MIN_CYCLE_T = 0x00000fa0millisec	
(22) MEMORY_SIZE = 0x0000Kbytes	
(23) NV_CYCLE_T = 0x01b77400millisec	
(24) FREE_SPACE = 0%	
(25) FREE_TIME = 89.5693%	
(26) SHED_RCAS = 0x0009c400millisec	

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Table 11.1 Logix 1400-011 : RS-011 (RB) (3 of 4)

Configuration File Data	Comments
(27) SHED_ROUT = 0x0009c400millisec	
(28) FAULT_STATE = Clear	
(29) SET_FSTATE = OFF	
(30) CLR_FSTATE = Off	
(31) MAX_NOTIFY = 0x08	
(32) LIM_NOTIFY = 0x08	
(33) CONFIRM_TIME = 0x0009c400millisec	
(34) WRITE_LOCK = Not Locked	
(35) UPDATE_EVT = UNACKNOWLEDGED = Un-initialized UPDATE_STATE = Un-initialized TIME_STAMP = 01/01/72 00:00:00 (MM/DD/YY HH:MM:SS) STATIC_REVISION = 0x0000 RELATIVE_INDEX = 0x0000	
(36) BLOCK_ALM = UNACKNOWLEDGED = Unacknowledged ALARM_STATE = Active-Not Reported TIME_STAMP = 10/07/98 11:46:49 (MM/DD/YY HH:MM:SS) SUB_CODE = OutOfService VALUE = 0x00	
(37) ALARM_SUM = CURRENT = Block Alarm UNACKNOWLEDGED = Block Alm Unack UNREPORTED = Block Alm Unrep DISABLED = 0x0000	
(38) ACK_OPTION = 0x0000	
(40) WRITE_ALM = UNACKNOWLEDGED = Un-initialized ALARM_STATE = Un-initialized TIME_STAMP = 01/01/72 00:00:00 (MM/DD/YY HH:MM:SS) SUB_CODE = Other VALUE = Discrete state 0	
(41) DL_CMD1 = 0x00	
(42) DL_CMD2 = 0x00	
(43) DL_APPSTATE = 0x0000	
(44) DL_SIZE = 0x000351b0	
(45) DL_CHECKSUM = 0xff6f	

Table 11.1 Logix 1400-011 : RS-011 (RB) (4 of 4)

	Configuration File Data	Comments
(46)	REVISION_ARRAY = REVISION_ARRAY = 0x0100 REVISION_ARRAY = 0x0100 REVISION_ARRAY = 0x0020	
(47)	BLOCK_TEST = BLOCK_TEST = 0x37 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00	Constantly increases
(48)	ERROR_DETAIL = ERROR_DETAIL = 0x0000 ERROR_DETAIL = 0x0000 ERROR_DETAIL = 0x0000	

Table 11.2 Logix 1400-011 : XD-011 (FVPTB) (1 of 5)

	Configuration File Data	Comments
(1)	ST_REV = 0x0000	Block tagname (Transducer Block) (index) parameter mnemanic = value
(2)	TAG_DESC =	
(3)	STRATEGY = 0x0000	
(4)	ALERT_KEY = 0x00	
(5)	MODE_BLK = TARGET = Auto ACTUAL = Auto PERMITTED = Auto | OOS NORMAL = Auto	
(6)	BLOCK_ERR = 0x0000	
(7)	UPDATE_EVT = UNACKNOWLEDGED = Un-initialized UPDATE_STATE = Un-initialized TIME_STAMP = 01/01/72 00:00:00 (MM/DD/YY HH:MM:SS) STATIC_REVISION = 0x0000 RELATIVE_INDEX = 0x0000	

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Table 11.2 Logix 1400-011 : XD-011 (FVPTB) (2 of 5)

Configuration File Data	Comments
(8) BLOCK_ALM = UNACKNOWLEDGED = Unacknowledged ALARM_STATE = Un-initialized TIME_STAMP = 01/01/72 00:00:00 (MM/DD/YY HH:MM:SS) SUB_CODE = OutOfService VALUE = 0x00	
(9) TRANSDUCER_DIRECTORY = 0x0000	
(10) TRANSDUCER_TYPE = 0x0000	
(11) XD_ERROR = None	
(12) COLLECTION_DIRECTORY = 0x00000000	
(13) FINAL_VALUE = STATUS = Good_Cascade::NonSpecific:NotLimited VALUE = 0	
(14) FINAL_VALUE_RANGE = EU_100 = 105 EU_0 = -5 UNITS_INDEX = % DECIMAL = 0x01	
(15) FINAL_VALUE_CUTOFF_HI = 105	
(16) FINAL_VALUE_CUTOFF_LO = -5	
(17) FINAL_POSITION_VALUE = STATUS = Good_NonCascade::NonSpecific:NotLimited VALUE = 83.07	
(18) SERVO_GAIN = 1	
(19) SERVO_RESET = 0	
(20) SERVO_RATE = 0	
(21) ACT_FAIL_ACTION = UNDEFINED	
(22) ACT_MAN_ID = 0x00000000	
(23) ACT_MODEL_NUM = (NULL)	
(24) ACT_SN = (NULL)	
(25) VALVE_MAN_ID = 0x00000000	
(26) VALVE_MODEL_NUM = (NULL)	
(27) VALVE_SN = (NULL)	
(28) VALVE_TYPE = UNDEFINED	
(29) XD_CAL_LOC =	

Table 11.2 Logix 1400-011 : XD-011 (FVPTB) (3 of 5)

	Configuration File Data	Comments
(30)	XD_CAL_DATE = 01/01/00 00:00:00 (MM/DD/YY HH:MM:SS)	
(31)	XD_CAL_WHO = (NULL)	
(32)	DAC_PERCENT = 0	
(33)	CONTROL_FLAGS = 0x6f	
(34)	GAIN_UPPER = 0	
(35)	GAIN_LOWER = 0.16	
(36)	GAIN_MULT = 1.59	
(37)	IGAIN = 0x0000	
(38)	IL_OFFSET = 0.05	
(39)	STATUS_FLAGS = 0x08	
(40)	CMD_USED = 55	
(41)	CALIBRATE = 0x00	
(42)	DAC_VALUE = 0x0000	
(43)	PRESS_CAL = 0.62	
(44)	CALIBRATE_FLAGS = 0x00	
(45)	SOFTSTOP_HIGH = 110	
(46)	SOFTSTOP_LOW = -10	
(47)	CYCLE_COUNTER = 0x00000006	
(48)	CYCLE_DEADBAND = 20	
(50)	TRAVEL_ENG = 4.9729	
(51)	TRAVEL_DEADBAND = 20	
(52)	TRAVEL_ALERT = 2e+006	
(53)	STROKE_ENG = 1	
(54)	TRAVEL_UNITS = 0x2f	
(55)	FUTUREXD1 = 0x0000	
(56)	FUTUREXD2 = 0x0000	
(57)	TRAVEL_FLAGS = 0x00	
(58)	TEMPERATURE = 0x9200	
(59)	TOP_PRESSURE = 45	

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Table 11.2 Logix 1400-011 : XD-011 (FVPTB) (4 of 5)

Configuration File Data	Comments
(60) BOTTOM_PRESSURE = 0.01	
(61) SUPPLY_PRESSURE = 65	
(62) VOLTAGE_REFERENCE = 0.032	
(63) HALL_SENSOR = 0	
(64) DAC_CHECK = 0	
(65) MOD_CURRENT = 0	
(66) IL_CHK = 0x0000	
(67) INTERNAL_FLAGS = 0x00	
(68) PRESS_FLAGS = 0x00	
(69) PRESS_UNITS = psi	
(70) TEMP_UNITS = Degrees Celsius	
(71) ELECTRONICS_SN = (NULL)	
(72) SOFTWARE_VER = 0x20F4	
(73) FUTUREXD3 = STATUS = Good_Cascade::NonSpecific:NotLimited VALUE = Discrete state 0	
(74) FUTUREXD4 = 0x00000000	
(75) SPI_TEST_RCV = SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00 SPI_TEST_RCV = 0x00	

Table 11.2 Logix 1400-011 : XD-011 (FVPTB) (5 of 5)

	Configuration File Data	Comments
(76)	SPI_TEST_TX = SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00 SPI_TEST_TX = 0x00	
(77)	BLOCK_TEST = BLOCK_TEST = 0x34 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00	Constantly increases

Table 11.3 Logix 1400-011 : AO-011 (AO) (1 of 3)

	Configuration File Data	Comments
(1)	ST_REV = 0x0002	Block tagname (Analog output) (index) parameter mnemonic = value
(2)	TAG_DESC =	
(3)	STRATEGY = 0x0000	
(4)	ALERT_KEY = 0x00	
(5)	MODE_BLK = TARGET = Auto ACTUAL = Auto PERMITTED = RCas | Cas | Auto | Man | OOS NORMAL = Auto	
(6)	BLOCK_ERR = 0x0000	

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Table 11.3 Logix 1400-011 : AO-011 (AO) (2 of 3)

Configuration File Data	Comments
(7) PV = STATUS = Good_NonCascade::UnacknowledgedBlockAlarm:NotLimited VALUE = 82.78	
(8) SP = STATUS = Good_Cascade::NonSpecific:NotLimited VALUE = 83.04	
(9) OUT = STATUS = Good_Cascade::NonSpecific:NotLimited VALUE = 0	
(10) SIMULATE = SIMULATE_STATUS = Bad::NonSpecific:NotLimited SIMULATE_VALUE = 0 TRANSDUCER_STATUS = Good_Cascade::NonSpecific:NotLimited TRANSDUCER_VALUE = 0 ENABLE_DISABLE = Un-initialized	
(11) PV_SCALE = EU_100 = 100 EU_0 = 0 UNITS_INDEX = 0x0000 DECIMAL = 0x00	
(12) XD_SCALE = EU_0 = 0 UNITS_INDEX = 0x0000 DECIMAL = 0x00	
(13) GRANT_DENY = GRANT = 0x00 DENY = 0x00	
(14) IO_OPTS = 0x0000	
(15) STATUS_OPTS = 0x0000	
(16) READBACK = STATUS = Good_NonCascade::NonSpecific:NotLimited VALUE = 82.78	
(17) CAS_IN = STATUS = Good_Cascade::NonSpecific:NotLimited VALUE = 0	
(18) SP_RATE_DN = 1.#INFPV/Sec	
(19) SP_RATE_UP = 1.#INFPV/Sec	
(20) SP_HI_LIM = 100	

Table 11.3 Logix 1400-011 : AO-011 (AO) (3 of 3)

Configuration File Data	Comments
(21) SP_LO_LIN = 0	
(22) CHANNEL = 0x0001	
(23) FSTATE_TIME = 0Sec	
(24) FSTATE_VAL = 0	
(25) BKCAL_OUT = STATUS = Good_Cascade::NonSpecific:NotLimited VALUE = 0	
(26) RCAS_IN = STATUS = Good_Cascade::NonSpecific:NotLimited VALUE = 0 Initialized value = Un-initialized, must be set to valid value	
(27) SHED_OPT = NormalShed_NormalReturn	
(28) RCAS_OUT = STATUS = Good_Cascade::NotInvited:NotLimited VALUE = 83.04	
(29) UPDATE_EVT = UNACKNOWLEDGED = Unacknowledged UPDATE_STATE = Un-initialized TIME_STAMP = 01/01/72 00:00:00 (MM/DD/YY HH:MM:SS) STATIC_REVISION = 0x0002 RELATIVE_INDEX = 0x001b	
(30) BLOCK_ALM = UNACKNOWLEDGED = Unacknowledged ALARM_STATE = Active-Not Reported TIME_STAMP = 10/07/98 11:53:59 (MM/DD/YY HH:MM:SS) SUB_CODE = OutOfService VALUE = 0x00	
(31) WSP = STATUS = Good_Cascade::NonSpecific:NotLimited VALUE = 83.04	
(32) BLOCK_TEST = BLOCK_TEST = 0xb9 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x0f BLOCK_TEST = 0xc4	Constantly increases

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Table 11.4 Logix 1400-011 : PID-011 (PID) (1 of 5)

	Configuration File Data	Comments
(1)	ST_REV = 0x0002	Block tagname (PID Control Block) (index) Paramter mnemonic = value
(2)	TAG_DESC =	
(3)	STRATEGY = 0x0000	
(4)	ALERT_KEY = 0x00	
(5)	MODE_BLK = TARGET = Auto ACTUAL = Auto PERMITTED = ROut | RCas | Cas | Auto | Man | OOS NORMAL = Auto	
(6)	BLOCK_ERR = 0x0000	
(7)	PV = STATUS = Good_Cascade::NonSpecific:NotLimited VALUE = 0	
(8)	SP = STATUS = Good_Cascade::NonSpecific:LowLimited VALUE = 0	
(9)	OUT = STATUS = Good_Cascade::NonSpecific:NonLimited VALUE = 0	
(10)	PV_SCALE = EU_100 = 100 EU_0 = 0 UNITS_INDEX = 0x0000 DECIMAL = 0x00	
(11)	OUT_SCALE = EU_100 = 100 EU_0 = 0 UNITS_INDEX = 0x0000 DECIMAL = 0x00	
(12)	GRANT_DENY = GRANT = 0x00 DENY = 0x00	
(13)	CONTROL_OPTS = 0x0000	
(14)	STATUS_OPTS = 0x0000	
(15)	IN = STATUS = Good_NonCascade::NonSpecific:NotLimited VALUE = 0	

Table 11.4 Logix 1400-011 : PID-011 (PID) (2 of 5)

Configuration File Data	Comments
(16) PV_FTIME = 0Sec	
(17) BYPASS = Off Initialized value = uninitialized, must be set to valid value	
(18) CAS_IN = STATUS = Good_NonCascade::NonSpecific:NotLimited VALUE = 0	
(19) SP_RATE_DN = 1.#INFPV/Sec	
(20) SP_RATE_UP = 1.#INFPV/Sec	
(21) SP_HI_LIM = 100	
(22) SP_LO_LIM = 0	
(23) GAIN = 0	
(24) RESET = 5Sec	
(25) BAL_TIME = 0Sec	
(26) RATE = 0Sec	
(27) BKCAL_IN = STATUS = Good_Cascade::NonSpecific:NotLimited VALUE = 0	
(28) OUT_HI_LIM = 100	
(29) OUT_LO_LIM = 0	
(30) BKCAL_HYS = 0.5%	
(31) BKCAL_OUT = STATUS = Good_Cascade::NonSpecific:NotLimited VALUE = 0	
(32) RCAS_IN = STATUS = Good_Cascade::NonSpecific:NotLimited VALUE = 0	
(33) ROUT_IN = STATUS = Good_Cascade::NonSpecific:NotLimited VALUE = 0	
(34) SHED_OPT = NormalShed_NormalReturn Initialized value = uninitialized, must be set to a valid value	
(35) RCAS_OUT = STATUS = Good_Cascade::NotInvited:Constant VALUE = 0	

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Table 11.4 Logix 1400-011 : PID-011 (PID) (3 of 5)

Configuration File Data	Comments
(36) ROUT_OUT = STATUS = Good_Cascade::NotInvited:LowLimited VALUE = 0	
(37) TRK_SCALE = EU_100 = 100 EU_0 = 0 UNITS_INDEX = 0X0000 DECIMAL = 0X00	
(38) TRK_IN_D = STATUS = Bad::OutOfService:NotLimited VALUE = Discrete State 0	
(39) TRK_VAL = STATUS = Bad::OutOfService:NotLimited VALUE = 0	
(40) FF_VAL = STATUS = Bad::OutOfService:NotLimited VALUE = 0	
(41) FF_SCALE = EU_100 = 100 EU_0 = 0 UNITS_INDEX = 0x0000 DECIMAL = 0x00	
(42) FF_GAIN = 0	
(43) UPDATE_EVT = UNACKNOWLEDGED = Unacknowledged UPDATE_STATE = Active-Not Reported TIME_STAMP = 10/07/98 11:53:12 (MM/DD/YY HH:MM:SS) STATIC_REVISION = 0x0002 RELATIVE_INDEX = 0x0022	
(44) BLOCK_ALM = UNACKNOWLEDGED = Un-initialized ALARM_STATE = Un-initialized TIME_STAMP = 10/07/98 11:53:12 (MM/DD/YY HH:MM:SS) SUB_CODE = Other VALUE = 0x00	
(45) ALARM_SUM = CURRENT = 0x0000 UNACKNOWLEDGED = 0x0000 UNREPORTED = 0x0000 DISABLED = 0x0000	
(46) ACK_OPTION = 0x0000	
(47) ALARM_HYS = 0.5%	

Table 11.4 Logix 1400-011 : PID-011 (PID) (4 of 5)

Configuration File Data	Comments
(48) HI_HI_PRI = 0x00	
(49) HI_HI_LIM = 1.#INF	
(50) HI_PRI = 0x00	
(51) HI_LIM = 1.#INF	
(52) LO_PRI = 0x00	
(53) LO_LIM = 1.#INF	
(54) LO_LO_PRI = 0x00	
(55) LO_LO_LIM = -1.#INF	
(56) DV_HI_PRI = 0x00	
(57) DV_HI_LIM = 1.#INF	
(58) DV_LO_PRI = 0x00	
(59) DV_LO_LIM = -1.#INF	
(60) HI_HI_ALM = UNACKNOWLEDGED = Un-initialized ALARM_STATE = Un-initialized TIME_STAMP = 01/01/72 00:00:00 (MM/DD/YY HH:MM:SS) SUB_CODE = Other VALUE = 0	
(61) HI_ALM = UNACKNOWLEDGED = Un-initialized ALARM_STATE = Un-initialized TIME_STAMP = 01/01/72 00:00:00 (MM/DD/YY HH:MM:SS) SUB_CODE = Other VALUE = 0	
(62) LO_ALM = UNACKNOWLEDGED = Un-initialized ALARM_STATE = Un-initialized TIME_STAMP = 01/01/72 00:00:00 (MM/DD/YY HH:MM:SS) SUB_CODE = Other VALUE = 0	
(63) LO_LO_ALM = UNACKNOWLEDGED = Un-initialized ALARM_STATE = Un-initialized TIME_STAMP = 01/01/72 00:00:00 (MM/DD/YY HH:MM:SS) SUB_CODE = Other VALUE = 0	

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Table 11.4 Logix 1400-011 : PID-011 (PID) (5 of 5)

	Configuration File Data	Comments
(64)	DV_HI_ALM = UNACKNOWLEDGED = Un-initialized ALARM_STATE = Un-initialized TIME_STAMP = 01/01/72 00:00:00 (MM/DD/YY HH:MM:SS) SUB_CODE = Other VALUE = 0	
(65)	DV_LO_ALM = UNACKNOWLEDGED = Un-initialized ALARM_STATE = Un-initialized TIME_STAMP = 01/01/72 00:00:00 (MM/DD/YY HH:MM:SS) SUB_CODE = Other VALUE = 0	
(66)	PID_FORM = IDEAL PID	
(67)	ALGO_TYPE = PID Type A	
(68)	OUT_LAG = 0	
(69)	GAIN_NLIN = 0	
(70)	GAIN_COMP = 0	
(71)	ERROR_ABS = 0	
(72)	WSP = STATUS = Good_Cascade::NonSpecific:LowLimited VALUE = 0	
(73)	FUTURE1 = 0	
(74)	BLOCK_TEST =	Constantly increases
	BLOCK_TEST = 0x3d BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x00 BLOCK_TEST = 0x0b BLOCK_TEST = 0xd1	

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Glossary

A/D: Also called ADC or analog-to-digital converter. An A/D converts an analog signal into an integer count. This integer count is then used by the micro controller to process information such as position, pressure and temperature.

D/A: Also called DAC or digital-to-analog converter. A D/A converts an integer count into an analog output signal. The D/A is used to take a number from the micro controller and command an external device such as a pressure modulator.

EEPROM: Electrically Erasable Programmable Read Only Memory. A device which retains data even when power is lost. Electrically erasable means that data can be changed. EEPROM have a limited number of times data can be re-written.

Micro controller: In addition to an integral CPU (microprocessor), the micro controller has built in memory and I/O functions such as A/D and D/A.

Microprocessor: Semiconductor device capable of performing calculations, data transfer, and logic decisions. Also referred to as CPU (Central Processing Unit).

Protocol: A set of rules governing how communications messages are sent and received.

Resolution: Resolution is a number which indicates the smallest measurement which can be made. You will often see Analog-to-Digital (A/D) converters referred to as a 10-bit A/D or a 12-bit A/D. 10-bit and 12-bit are terms which indicate the total number of integer counts which can be used to measure a sensor or other input. To determine the total integer count, raise 2 to the power of the number of bits.

Example:12-bit A/D
Total integer number = $2^{\text{Number of Bits}} = 2^{12} = 4096$
Resolution is the measurement range divided by the maximum integer number.

Example: A valve has a 2-inch stroke and a 12-bit A/D is used to measure position.
Resolution = Stroke/(maximum integer for 12-bit) = 2 inch/4096= 0.000488 inches

Sampling: Taking readings at periodic time intervals.

Serial Transmission: Serial transmission is a method of sending information from one device to another. One bit is sent after another in a single stream.

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